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INDUSTRIAL ACCIDENTS AND INDUSTRIAL DISEASES.

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Social responsibility for the physical condition of labor is a new conception in political science and one of the most modern as well as difficult functions of government. The idea itself has been evolved out of a vast amount of human suffering and social distress resulting from crude methods of industry and ill-defined relations of employers and employees. The common-law doctrine of the complete assumption of industrial risk by the workmen employed in more or less dangerous trades, excepting gross negligence on the part of the employer, is no longer tenable, and gradually a policy of *labor protection* is being perfected, which, in addition to a more or less clearly defined employers' liability, includes community responsibility for the social consequences of industrial accidents and industrial diseases.

The principle of social justice which shifts the trade risk upon the trade itself and makes it a part of the cost of production is fully justified by both ethical and economic considerations. The modern state is chiefly industrial, for even agriculture tends more and more to become an organized and intelligently co-ordinated branch of industry. Under the modern industrial system, labor efficiency is a factor of first importance, and this implies a maxmium of disease resistance, physical

strength, and a long trade life free from serious interruptions caused by preventable illness.

Labor efficiency is but slowly acquired, and its conservation is as much a matter of national concern as the conservation of natural resources. Industry to-day is recognized as a branch of social conduct, and, in the words of Hobson, "society will insist, in proportion as it comes to realize its own good, that the industrial system shall in its structure and working be brought into conformity with the wider material and moral conditions of social growth." Just as the waste of natural resources will not always continue to be tolerated as a rightful exercise of reckless private enterprise, so the waste of human life, health, strength, and ability in industrial undertakings will be reduced to a minimum by effective social regulation and the strict enforcement of rational statutory requirements. The principle as laid down by Hobson in his "Industrial System," is that "the human worth of any given stock of material or immaterial wealth must evidently vary, and vary indefinitely according to the good or bad conditions of its production, according to the good or bad conditions of its consumption. Where it is made by vigorous workers, on short hours under good hygienic and technical conditions, it will involve a minimum of painful or distasteful effort, human disutility; where it is made by feeble women or children working long hours in some insanitary workshop or home, it will involve a maximum of this disutility."

There is, therefore, economic as well as ethical justification for a deliberate state policy of labor protection, and such a policy resolves itself, in its final analysis, into a complete theory of social insurance, conditioned, however, by rational state control of the methods and conditions under which industrial activity shall be permitted to be carried on. It does not follow in practice that the government itself needs to undertake the solution of social and economic problems by perfected methods in insurance, but rather that government insurance is the final alternative of a complete solution of the question of social and labor security unless the end can be achieved by other means.

At this time, however, it is rather a question of actual condi-

tions than of final solutions. The facts which must ultimately govern a constructive policy of reform in the conditions injurious to life and health in industry are but imperfectly known and but imperfectly understood. There is, on the one hand, the unfortunate tendency towards undue exaggeration, and, on the other the equally lamentable attitude of stolid indifference. It is unjust to those who are responsible for the conduct of modern industry to speak of the "carnage of peace," and to draw the unwarranted inference that even a modern war is less disastrous in its consequences as measured by the loss of life and health than the normal conduct of modern industrial enterprise.

The striking comparisons which are often made to establish this absurd contention rest upon a deliberate misuse of statistics, which cannot be too severely condemned, as a deliberate attempt to lead the public astray. Thus, one statement is to the effect that "in New York City alone about 3,500 people variously employed come to a violent end every year, or more than nine a day." This statement practically includes *all* the accidents among adults in the city of New York, but it is evident that a very large proportion of these accidents are not in any manner whatever chargeable to industry or employment. The same writer states that, according to the census report on the mortality in 1906, there occurred "100,000 violent deaths that year," when, as a matter of fact, only 49,552 such deaths were actually recorded, but this number includes all ages and both sexes, and there is no information whatever contained in the report to show what proportion of the deaths were the result of industrial activity.

Statements of this kind are very common. They are widely quoted, and lead to totally erroneous inferences, reflected in radical laws and burdensome industrial regulations which are of more hindrance than help to the cause of industrial reform. As a matter of fact, the total yearly number of fatal accidents in the United States among occupied males aged fifteen and over is approximately 30,000, and, if all possible reasonable allowance is made for defects in death registration, the probable

number does not exceed 35,000.* At most about one-half, and probably less, represent fatal industrial accidents in the strict sense of the term, or such accidents as occur in connection with occupational activity or in consequence of the employments followed. Of this mortality a considerable proportion is, no doubt, the result of personal negligence and indifference, which the most stringent rules and regulations can only very slowly do away with. Workingmen will often needlessly expose themselves to danger, and they are equally careless and indifferent in exposing their fellow-workmen to serious risk. This is not, however, a condition peculiar to this country, but is common to all countries where the industrial system has been developed to a high degree of efficiency.

Of the 15,000 deaths per annum which are the probable result of industrial activity, a considerable proportion results from risks which, in all probability, can never be entirely eliminated. Certain dangers are inherent in trades and occupations and can only be done away with by prohibiting such industrial processes entirely. The mining of coal, the running of trains, the making of explosives, the sailing of ships, all involve natural and inherent dangers which the wisest policy and the most careful precaution can minimize, but not eliminate. The occupation accident mortality in such trades is the price of life itself, for these occupations or employments minister to the absolute needs of the people.

The facts as such require no exaggeration to emphasize the seriousness of the situation and the lamentable consequences which fall upon those who are practically helpless under the present state of affairs. Accidents are more common in most of our industries than in the industries abroad, partly because of the higher pressure under which our work is carried on and partly because of the rapid introduction of a new element of labor unfamiliar with our methods of mechanical production, but largely because of our general attitude of indifference toward human life itself. In coal mining alone there are lost

* Bulletin No. 78 of the United States Bureau of Labor, September, 1908.

annually over three thousand lives, and the rate is not only excessive, but it is increasing. Among railway trainmen the fatal accident rate while at work is nearly eight times the normal degree of accident frequency among males in all occupations, but even this rate is exceeded by deaths from drowning among the fishermen of Gloucester, resulting in a rate nearly twelve times the normal for men in all occupations. The degree of fatal accident liability varies, but it is high in most of the trades which can be considered at all dangerous, and there is evidence, conclusive and incontrovertible, that by rational methods of supervision and control the rates can be very materially diminished.

Regarding non-fatal accidents or injuries our information is much more imperfect, and is practically limited to a few of the more important dangerous occupations. In only one state has a real effort been made to arrive at a complete statement of the facts,—that is, Wisconsin,—but even there the effort as yet has not been entirely successful. The method of reporting non-fatal accidents varies so much that the returns for one state are seldom comparable with those for another. The same is true of different employments, for the returns may be complete for one industry, while for another they may be decidedly incomplete. There is also, of course, the inherent difficulty of giving a definite meaning to the term "accident," applicable to all conditions and industries alike, but until such a definition is arrived at a valid comparison of the degree of injury frequency in different trades will be extremely difficult. In Wisconsin, during the last year for which the information is available, there were 5,003 industrial accidents of all kinds, and of this number 135, or 2.7 per cent., were fatal; 574, or 11.5 per cent., resulted in permanent incapacity; while 4,141, or 82.8 per cent., caused only temporary incapacity. Three per cent. of the accident returns were undefined.*

Similar investigations for other states or countries prove conclusively that the industrial accident factor is of sufficiently

* Special Report of the Bureau of Labor of Wisconsin, 1909.

serious importance to warrant the development of a deliberate policy of government in dealing with the problem. There is not at present sufficient accountability, on the one hand, or sufficient criminal and civil responsibility, on the other, for the occurrence of accidents which are plainly chargeable to gross negligence or criminal indifference on the part of either employer or employee, or both.

In the case of industrial accidents the evidence of serious injury or of wrongful death is more readily apparent than in the case of industrial diseases. That term is as yet too ill-defined to warrant its entire inclusion in a deliberate state policy of labor reform. A few diseases are clearly recognized as trade diseases, such as lead-poisoning, anthrax, glass-blowers' cataract, etc., but many other diseases which, if not directly caused by the employment, are certainly intensified or accelerated in their course, may fairly be considered as trade diseases, such as consumption and certain forms of respiratory disease which are strictly within the category of industrial affections, and which diminish the industrial efficiency of the workman, shorten his life, and result in premature death, often with most lamentable consequences to surviving wives, children, or other dependents.*

Any extended consideration of the subject of industrial diseases is, of course, out of the question in a discussion of this kind. Referring, however, to the frequency of consumption among persons employed in dusty trades, the evidence is overwhelming that in almost exact proportion to the amount of dust exposure, modified by the character of the dust inhaled, the proportion of deaths from consumption is excessive, and decidedly excessive, among the young and the workers of middle age. Normally at ages twenty-five to thirty-four, among males in all occupations there occur, in every one hundred deaths from all causes, thirty-one deaths from consumption. Among grinders, however, the corresponding proportion of deaths from consumption is 71 per cent.; among tool and in-

* See Report of Departmental Committee on Industrial Diseases, London, 1907.

strument makers, 59 per cent.; among printers, 56 per cent.; among stone-workers, 53 per cent.; among weavers, 53 per cent.; among spinners, 50 per cent.; and among woollen and worsted mill employees, 44 per cent.*

These few illustrations will suffice to prove that upon the human element in some branches of industry there fall the most serious and lamentable consequences of disease and death, but of which at the same time a considerable proportion consists of diseases and deaths which, in their nature, are more or less preventable. In fact, it is not going too far to say that the causes responsible for industrial diseases are much more subject to control and gradual elimination than the causes and conditions responsible for industrial accidents.

These are some of the facts of industrial accidents and industrial diseases which are a matter of official record and which cannot be explained away. These deaths and diseases cannot, in a large proportion of the number of their occurrences, in fairness be charged to negligence and indifference on the part of the workmen, and their consequences should, in equal fairness, not fall upon them or their dependents in the event of serious illness or premature death. Since it is a recognized principle of law that dangerous industries may rightfully be carried on as necessary to the existence of society itself, it follows as a matter of simple justice that the consequences of such industrial enterprise should not fall upon the workman who, because of the necessity to earn his living, is compelled to engage therein.

It is absurd to speak of the workman's free will, the preferential selection of a dangerous over a non-dangerous employment, and it is also absurd to speak of it as being a matter of choice whether a man will or will not continue to follow a given occupation, for we well know that to the vast majority of the men who toil there is no choice whatever in a matter of this kind. It also cannot be denied that there is much human toil that has in itself no compensation to the worker beyond the fact that

* See Bulletins 79 and 82 of the United States Bureau of Labor, Washington, 1908–09, on the Mortality from Consumption in Dusty Trades.

it furnishes the means of sustaining life. It is not going too far even to say that many of the more dangerous occupations gradually dull the senses to such an extent that what may apparently be an act of negligence and indifference is in truth but the result of the work itself. The responsibility for the social consequences of industrial accidents or illness should, therefore, not rest wholly upon the laborer, whose wage at best and at most has furnished very little more than a plain living, but in conformity to a spirit of justice it should be a burden upon the cost of production, or, in other words, the vital cost of the industry should be charged to the total cost of the product.

This principle is incorporated in the British workmen's compensation act of 1906, which is free from the objections to be raised against an elaborate system of government insurance such as has been carried into effect during the last twenty-five years in Germany. The latter system has certain very important advantages, and it has unquestionably been productive of a definite and clearly traceable amount of good, but the unseen harm of the system is, to my way of thinking, greater, or more of a disadvantage, than the material good that has resulted. It is not the duty of the state to make men happy, nor is it the duty of the state as a primary consideration or at other people's expense to make them contented; but it is the duty of government to deal justly with its citizens, and to bring about the best possible labor conditions without serious injury to industry itself.

The true solution of the difficulty is *prevention as a duty* and *relief as a right* voluntarily conceded to labor as *a policy of labor protection* instead of the present chaotic condition of economic insecurity. Of these two alternatives the former is, in my opinion, of vastly more importance at the present time than the latter. Prevention of industrial accidents and trade diseases is possible to a very considerable extent, and very much more so and at less cost than generally assumed. It is, unfortunately, true that preventive industrial medicine has not made the progress in the United States which might have been reasonably

expected, considering the vast amount of advance in this direction that has been achieved in England and on the Continent, and for conclusive trade mortality statistics, as well as for statistical data pertaining to trade morbidity, our chief reliance is upon foreign data and foreign experience, since these matters have been almost entirely neglected in this country.

The official reports on the mortality of the State of Massachusetts, which was the first in the United States to establish the registration of deaths, contain no information whatever upon the important matter of industrial accidents and trade diseases. No really scientific analysis is made of the large experience gained from year to year, and it is only very recently that the first attempt has been made to institute a fairly comprehensive inquiry to determine the actual sanitary condition of the factories of the State.* The investigation was rather limited, but the results, even in their present form, are decidedly suggestive and of the greatest possible practical value. Referring, for illustration, to tool and instrument makers, it is stated that "the workmen are not, as a class, long-lived. Indeed, the nature of the work is not compatible with longevity, and a person entering in middle life is unlikely to follow it for many years. At whatever age the trade is taken up, the man who has followed it a few years is an acknowledged rarity." Similar evidence is presented regarding many other employments more or less injurious to health and life.

The conditions responsible for an excessive mortality in industry are, however, subject to control, and effective methods of ventilation and dust removal will very materially mitigate the evils which are now of common occurrence. The evidence is available to prove that in the cutlery grinding shops of Solingen stringent police regulations governing cleanliness and dust removal have been followed by a material reduction in the mortality. The German law requires that the walls of the work-rooms must

* Reports on Sanitary Conditions and Dangerous Occupations, Senate No. 27, Jan. 12, 1905, and Senate No. 250, March, 1907. Published by the State Board of Health, Boston, Mass.

be lime-washed every year. The floors must be swept every evening and damp-wiped once a week. The rasing of grindstones is never undertaken during working hours except under a stream of water or unless the stone is entirely enclosed in casing, except at the working place of the rasing tool. The floors are kept clean, and provision is made for the removal of the dust during grinding. Cutlery manufacture is recognized as a dangerous trade, and in recent years considerable improvement has taken place in the prevention of dust. The grindstones and polishing wheels are run *toward* the worker, while in Sheffield, England, where the mortality is very much higher, they are run away from the worker, so that the dust has an upward tendency, and flies into the room. This is but one of many similar illustrations, but it is a pertinent one to emphasize trade conditions, over which the employees themselves have but a limited amount of control.

Commenting upon the unsatisfactory conditions in the stone industry at Quincy, the Massachusetts report previously referred to states that this is pre-eminently a dusty trade, and that the workmen are exposed to the danger of inhaling unabsorbable and irritating particles of mineral matter. Of 343 deaths which occurred in the city of Quincy among stone-cutters, no fewer than 142, or 41.4 per cent., were due to pulmonary tuberculosis, and 41, or 12 per cent. more, to other diseases of the lungs. This also is an industry where dust prevention is possible in a much more effective manner than has thus far been attempted, but in this case, as in so many others, the efforts at sanitary reforms are often opposed by the men themselves. Many years ago, in fact, Mr. Charles Francis Adams, in his treatise on railway accidents, pointed out how it had been necessary to make it a crime on the part of railway employees to remove the very safeguards adopted for their protection; and we are officially informed that among tool and instrument makers in Massachusetts, "in establishments properly equipped and conducted, provision is made to reduce the danger of dust to a minimum by means of hoods connected with a system of exhaust fans or blowers, but a very large proportion of grinders recklessly

remove the hoods and thus expose themselves unnecessarily to this especially dangerous form of dust."

It will thus be seen that the problem of labor protection is by no means a simple one, but that for its successful solution it depends upon the hearty and intelligent co-operation of employers and employees. Preventive measures will in the long run prove effective just as the safeguards in connection with the running of railway trains, and, while it will take time, patience, and expense, every investment of this kind will produce good results in the future. Even granting that the workmen themselves are, to a certain extent, responsible for the ills which affect them, the social consequences of their misconduct fall heavily upon dependent widows and children, who are of right entitled to the solicitude of the state.

It would carry me entirely too far to discuss the methods and means of accident or disease prevention which fall within the field of industrial medicine or industrial hygiene. Only one matter I may speak of, and that is the problem of ventilation and dust removal in trades which by their nature give rise to much dust production. In connection with this subject, which has not received much scientific attention in this country, I may mention the very valuable results obtained by an English departmental committee appointed to inquire into the ventilation of factories and workshops.* The two reports published by this committee prove conclusively that very material improvements are possible, and it necessarily follows that such improvements in the physical condition under which work is carried on will be followed by an improvement in health and longevity. The principle evolved out of these and similar investigations is precisely stated by Sir James Crichton-Browne as follows: "In contending with certain special kinds of dust, special appliances and arrangements are necessary; but for dust, as a whole, our aim should

* Ventilation of Factories and Workshops. Reports of Departmental Committee, First and Second, with Appendix. Parliamentary Reports, C. 1302 and Cd. 3552. London, 1902–07.

be to intercept and *remove it at its point of origin* and to insure a bounteous supply of fresh air."

The results to the industry itself as a direct means of increased industrial efficiency are stated, in the opinion of one leading manufacturer, as follows: "The effect of improved ventilation on the health of the workers has been good. We have had less staying away through sickness than before we had artificial humidity and ventilation in our sheds. The earnings have been more regular, but we do not find that they have increased as much as we expected; but the effect of the change has been advantageous to the manufacturer, the quality of the work being better and more perfect." Thus, as I had occasion to say in my article on the "Mortality from Consumption in Dusty Trades,"* "the effect of scientific ventilation of factories and workshops, and in particular the effective removal of industrial dust, combine to emphasize the need of more or less radical changes in the conditions as they exist at the present time."

It is, therefore, not only theoretically advisable, but practically feasible, to reduce the frequency of industrial diseases, of which consumption is numerically the most important. Other afflictions, more specifically recognized as trade diseases, such as phosphorus necrosis, lead-poisoning, and anthrax, are practically eliminated by a rigid control of the sanitary conditions under which the industries in which these diseases occur are in modern countries permitted to be carried on. While the problem is a more difficult one in the sanitary reform of the conditions which favor the spread of tuberculosis among indoor workers, the successful efforts which have been made in this direction encourage the hope that a material reduction in the mortality from these diseases can be brought about by a deliberate campaign directed specifically toward the elimination of the causes which give rise to disease.

What is true of trade diseases is true of industrial accidents, the number of which can be materially diminished by effec-

* Bulletin No. 79 of the United States Bureau of Labor, Washington, D.C., 1908 (includes extended list of references to occupation mortality).

tive rules and regulations governing the safe conduct of industrial activity. The actual number of fatal accidents in the coal mines of North America has increased from about 1,000 in 1898 to nearly 3,000 in 1907. The relative rate per 1,000 employed has changed for the worse from 2.6 during the first to 4.2 during the last year of the decade. In mining accidents, as in most industrial occupations, it is not the great calamities attracting world-wide attention that really are the most serious, but the accidents which occur from day to day and which are hardly even referred to in the daily press. Most of the accidents in coal mining are due to falls of roof, and, while this fact is well known and understood, as yet no really effective safety devices have been introduced to diminish the frequency of death from this preventable cause. I say preventable advisedly, because there is one very conclusive experience of a method adopted at the Courrieres mines in France, which consists, first, in systematic timbering, second, in supplying the worker at the face with three iron bars which form a sort of temporary shield in advance of the last row of timber props. The expense of this precaution is practically nil, but the saving in life is measured by a positive decline in the death-rate from 0.76 per 1,000 employed at the mines during 1870–79 to 0.15 during the ten years ending with 1899. In contrast to this remarkably low death-rate from falls of roof the corresponding accident rate for all France was 0.59, and for the United Kingdom 0.79, while for the United States it is probably not much less than 1.5 per 1,000 employees, if not more.

Every branch of industrial activity is subject to peculiar conditions and circumstances which need to be studied, and in the light of which safety rules and regulations can be adopted. We as yet hardly make our industrial casualties a complete matter of official record, or, if this is done, the facts themselves are not presented in sufficient detail to warrant valid inferences and definite suggestions for remedial measures. Whatever opinion may be held regarding German government insurance, it has at least resulted in one immeasurable advance, and that

is the development of a deliberate policy of labor security against industrial accidents in all of the various trades embraced by the accident branch of the government insurance department. For each of these trades there has been carefully worked out a set of rules and regulations, and the rules themselves are placed conspicuously in every factory and workshop for the instruction and guidance of the workmen. The posting of these rules is required by law, and substantial penalties are attached to neglect of any of the precautions, safeguards, or safety devices which the rules and regulations call for. One simple rule, which has hardly as yet been adopted in any American factory, although it unquestionably tends successfully to protect life and limb, is that all dangerous parts of machinery must be *painted conspicuously in red.* Every dangerous part is also required to be enclosed in such a manner that loose clothing, hair, etc., cannot easily be caught by moving machinery. Manufacturers no longer make many machines without these protective devices, since they form a part of the actual cost of production and an integral element of factory expense.

Granting that many of these precautions, perhaps, go too far and involve a more or less needless expense in the aggregate, the sum thus wasted is but a small item compared with the enormous amount of good which is actually accomplished. What the German government does in this direction will in course of time unquestionably become the established practice in this country, because the practice itself is based upon sound considerations of public policy. The tendency of states under modern conditions, it has very well been said, is to approach one another to attain a degree of uniformity in at least the essential features of government, and in no field is such conformity more likely to be followed by beneficial results than in the development of a rational policy of labor protection, designed primarily to prevent needless industrial accidents and trade diseases.

After this rather extended consideration of the prevention of industrial accidents and industrial diseases as a social duty,

I can only very briefly touch upon the problem of relief or compensatory damages as a right. Employers' liability for wrongful death and personal injury is to-day a recognized principle in the social legislation of all civilized countries, but in the United States and its constituent states even the most advanced legislation leaves much, if not most, to be desired. Since all that need be said upon this subject has been admirably summarized in Bulletin No. 74 of the United States Bureau of Labor, those who wish for more information are referred to that publication.

The tendency of American law-making has been clearly in line with early English legislation, but we have hardly advanced beyond the English Employers' Liability Act of 1880, which has long since been superseded in England by the acts of 1897 and 1906. These last two acts have established the right of workmen to compensatory damages, and the consequences of wrongful deaths and injuries now properly fall upon industry, and not upon the labor employed therein. In brief, the English acts grant to workmen the right to three years' average wages in the event of accidental death; and, in the event of non-fatal accidents and certain industrial diseases, to compensation of one-half of the normal wages earned. The acts have been of very substantial advantage to wage-earners otherwise without adequate protection, and, so far as it is possible to judge, the resulting burden upon English industry has not been so serious as was originally anticipated.

As pointed out by Sir Thomas Oliver,* "A money value has been assigned to human life which, in the event of the death of a workman by accident, is in full dependency regarded as equivalent to the earnings of the three years immediately previous to the injury, to £150 as a minimum and £300 as a maximum." Fortunately, he observes, "it is only a small percentage of accidents that prove fatal." In regard to non-fatal accidents the Workmen's Compensation Act of 1906 provides for 50 per cent. of the wages being given as compen-

* "Some Medical and Insurance Problems arising out of Recent Industrial Legislation," by Sir Thomas Oliver, M.D., London, 1909.

sation to workmen during incapacity caused by accident occurring while at work, but the compensation is not to exceed £1 a week, and nothing at all is to be paid unless the incapacity lasts longer than one week.* There are, naturally, qualifications and exceptions, but for the present purpose they do not need to be considered. In the opinion of Sir Thomas Oliver, who has written very ably on the subject, there is not the least doubt that the Workmen's Compensation Act has imposed a heavy burden upon employers, but this becomes comparatively light when it is met by insurance and a distribution of the risk. To workingmen, he remarks, the gain through the act has been enormous. By employers distributing their claims over federated boards and insurance offices, injured workingmen have been placed beyond the pale of absolute poverty, —*an advantage not otherwise easily secured.* While these advantages are clearly recognized, there have unfortunately been substantial disadvantages, the importance of which it would not be wise to minimize.

The English experience since 1906 proves conclusively that in a not inconsiderable proportion of cases injured workmen have deliberately imposed upon their employers and have been recipients of pecuniary damages to which they were not rightfully entitled. While there has been no increase in fatal accidents, there has been a decided increase in minor accidents, and once more, to quote Sir Thomas Oliver, "statistics and experience prove that men who receive trivial injuries frequently extend their incapacity into the second week, with the object of securing compensation. In collieries it has been found that the number of non-fatal accidents lasting more than two weeks has steadily increased during the last ten years, so that in 1907 the number was almost double what it was in 1898." In Germany and France similar consequences have followed the establishment of compulsory insurance for accidents. These circumstances open up the important question as to how far, after injury, men honestly or dishonestly consider themselves

* The law reads that "if the incapacity lasts less than two weeks, no compensation shall be payable in respect of the first week."

disabled for work in order to receive compensation. There is, unfortunately, a strong temptation to men who have received minor injuries to protract the effects of these injuries into the second week and beyond so as to *receive payment.* This, however, is a subject which cannot be dealt with here in detail.

Not only has an additional burden been placed upon the industry, but a corresponding burden has fallen upon friendly societies. By insuring in two or three of these societies dishonest men are now enabled to secure a larger income through fraud and imposition than they could earn through honest work. Particularly has this been observed to be the case with miners, and the sickness experience of some of the societies in the mining districts has been 20 per cent. to 75 per cent. greater than expected. Experience shows that, since the Workmen's Compensation Act of 1906 came into force, men are longer on the sick list than formerly, and they are becoming more and more disinclined to recommence work than in former years. Incapacity under the present act has, therefore, a money value which decidedly encourages malingering.

The moral consequences of the Workmen's Compensation Acts have not, therefore, been favorable. Compulsory insurance on the Continent has also failed to bring about a higher sense of personal responsibility on the part of the beneficiaries, who have not been slow to abuse the advantages of humane measures intended solely for their benefit. It has been stated at one of the meetings of the British Medical Association, by one in authority to express a qualified opinion on the subject, that "it is sad to find by painful experience to what an extent unfair advantage is taken of this act by some of those for whose benefit the laws were framed. Instead of honestly trying to get back to work as soon as possible, thus proving their manly independence and retaining their self-respect, the injured workmen in too many instances try to persuade themselves and their medical examiners that they are incapacitated for work long after their condition justified such a contention. The hope of obtaining a lump sum in such compensation no doubt acts in

some cases as a strong motive to confess that no improvement is taking place in their condition."

Even more lamentable has been the wholly unexpected development of dishonest medical practice to secure to the injured workmen benefits to which they are not rightfully entitled. In France, according to an article in the *British Medical Journal*, doctors do not hesitate to give false certificates, which are used by workmen to extort compensation. These and other difficulties are, of course, too involved to receive extended consideration at this time. The available evidence, however, is sufficiently clear that the passage of drastic workmen's compensation acts is certain to be followed by more or less unfavorable consequences, both financial and moral, unless the provisions are framed with extreme care and a method of rigid and expert supervision is employed by which alone imposition, malingering, and fraud can be reduced to a minimum.

The alternative to workmen's compensation laws is compulsory workmen's accident insurance on a contributory or a non-contributory basis. The German compulsory system in actual practice has some decided advantages over the English. In the accident branch the whole burden of cost falls upon industry, and there are no contributions from the workmen. The interrelation of the accident branch with the sickness and old-age and invalidity branches makes it difficult clearly to establish the true incidence of cost, since, for the first thirteen weeks of injury, accident cases are compensated for out of the sick fund. Since, however, only a part of the accident risk is really inherent in the industry, and since many accidents occur which are due to other causes than industrial employment, it seems but fair that the workmen should contribute their share to obtain the largest possible benefit on an equitable and moral basis of benefits received for services rendered. The English and German precedents, however, will probably defeat propositions for joint contributions on the part of employers and employees to meet the complete risk of industrial accidents and industrial diseases. From a practical point of view there is much to be said in favor of this principle. It is

necessary to keep in mind that, aside from other reasons, the first requirement is absolute certainty to the workman and his family that compensation will be made in the event of death or incapacity to work, as the result of accidental injury, whether the accident results from his own or his employer's faults and shortcomings or because of the true accident liability inherent in all employments.

Granting, therefore, the right of workmen to compensation under any and all circumstances arising out of industrial accidents and certain well-defined forms of industrial disease, the question remains whether the remedy lies in the direction of the workmen's compensation law of England or the German compulsory system of insurance. The German system in practice has advantages which, thus far at least, have not resulted from the English system. Under the latter the risk to the employer is covered by employers' liability insurance, the cost of which is probably as great, if not greater, in some industries at least, as under the German system. Sir Thomas Oliver has pointed out that the insurance premium has increased from 9*s.* 3*d.* per £100 of the wages paid in 1900 in the case of a large coal owners' association to 19*s.* per £100 in 1907, or more than 100 per cent. In the case of a large engineering firm at Newcastle the rate to-day is nearly twice what it was formerly. It is pointed out, however, that employers who have their own accident funds can run the insurance cost at a smaller sum than when done through an insurance office, which in some trades more dangerous than others may require 15*s.* or more per £100 of insurance. The cost of insurance rises naturally the more hazardous the trades are considered, but the insurance premium under the English system is only a rough approximation to the risk.

This difficulty is met in the German system by trade associations into which the employers in clearly defined industries are compelled to organize so that each branch of trade pays its own trade risk. The burden is equitably distributed among the different branches by a revision of the actual experience at least once in every five years. The resulting so-called danger

tariffs are in almost exact conformity to the true accident factor in different branches of the industry. For example, in textile manufacture the rate varies from 0.2 per cent. of the wages paid in the case of hand-loom weavers to 3.8 per cent. in the case of shoddy manufacture. It is self-evident that in all these industries there are many mechanical, allied, contiguous, and supplementary employments where the accident rate may be much higher or lower than in the risk of the industry as a whole. It is, therefore, only fair that every well-defined branch of the industry should pay its proportionate share of cost. To illustrate, in textile manufacture the spinning and weaving rooms should be separate and distinct in their contributions to the accident fund from the picking and carding rooms, and in mining the labor above ground should not be charged with the same rate of contributions as the labor below ground. While this at first may seem very complicated, it has, nevertheless, been found practicable in German experience to perfect the danger tariffs with a remarkable degree of success, hence the burden of accident insurance, as it falls upon German industry, is almost identical with the true risk of the trade, and there is in this respect practically no serious complaint.

Since, under the German system, employers are federated in accident insurance institutions, they are subject only to statutory requirements as to what they must do and what they must not do, but otherwise they have complete control over their own affairs. They are supervised through the Imperial Insurance Office, but there is a minimum degree of actual interference, and this only for strictly justifiable causes. The German system, therefore, makes it decidedly to the interest of every branch of industry to reduce accidents and industrial diseases to a minimum, and, while even under the German system malingering cannot be prevented, there are strong reasons to believe that there is less of it in Germany than in England.

The remarkable success with which industry is supervised in all its branches at a minimum of expense and a maximum of benefits is in itself a justification for the German system, even

if it did not as a first consideration grant to workingmen financial relief as a right in the event of accidental injury. It imposes the *duty* upon all industrial establishments to improve the conditions of work and to reduce industrial accident and disease liability to a minimum. This has been carried out through thoroughly intelligent rules and regulations of accident and disease prevention, which are without a parallel in any other part of the world. There are no workmen to-day anywhere whose health and safety are better safeguarded than the workmen in German industrial establishments, and there is not the slightest doubt but that the effect of these rules and regulations has been far-reaching in both its moral and economical consequences. The industrial efficiency of the German workman in important respects is superior to that of any other, because his health and his strength are better conserved than is the case in other lands. Many valuable lives are saved or prolonged, which represent years of industrial experience and acquired ability, and which are recklessly wasted or destroyed in our own country.

While for the time being we have certain economic and other industrial advantages, and while our native-born workmen have admittedly a higher degree of mechanical skill, ingenuity, and adaptability to new processes of manufacture, this is probably only a transitory condition which must soon pass away. Where the German workman has a substantial advantage is in the fostering of the conditions which favor plodding industry and average mechanical skill, accompanied by rising wages and shorter hours, which, after all, make up the sum and substance of enduring industrial success. In the sustaining of these qualities and in the perfection of these abilities the German accident insurance system is unquestionably of the greatest possible assistance.

When a system or method of social reform is productive of decidedly beneficial results to the people of one country, it is certain to cause the adoption of similar or corresponding methods in other countries. Whether American employers of labor will ultimately be compelled by law to make specific

compensation for industrial accidents and diseases, but in a more or less haphazard manner and subject to the risk of widespread imposition and fraud, or whether they will succeed in meeting this liability by employers' liability insurance, or whether they will voluntarily inaugurate a system of workmen's insurance through the federation of large industries and joint contributions to a common fund, are, of course, open questions to which at this time no answer can be given. It is certain, however, that one of these methods will finally be adopted.

All problems of this character depend for their successful solution upon a sound basis of statistical facts. While the present state of our knowledge with regard to the true degree of accident or disease frequency in industry is not very satisfactory, nevertheless, data to a considerable amount are available, which have been briefly consolidated in the form of a series of tables in the Appendix to this paper. The tables will afford a convenient means of reference, since most of the facts are not easily obtained in their present form, even from the official reports which contain them. They will prove useful to those who are interested in the best possible solution of the problem under consideration, as well as in a correct presentation, of the available facts regarding the probable rate of accident frequency in American industry and the related subjects of American employers' liability insurance experience and workmen's compensation law in England.

Granting that the day is not far distant when employers' liability will be both real and practical and when the right of the employee to relief or compensation will be made corresponding to the duty on the part of the employer to introduce all reasonable safety precautions and devices, large employers of labor would seem to be indifferent to their own interests in not taking time by the forelock in the inauguration of federated accident institutions, with a full equipment of modern methods for technical supervision and resulting accident and disease prevention. There can be no doubt that the actual cost of the most effective method of accident insurance, granting to the

employee in the event of injury, or to his family in the event of his death, a sufficient amount of compensation to at least materially mitigate the economic consequences of that disaster, is a duty and a necessity of the not far distant future. Equally clear is the growing sense of community responsibility, that many, if not most, of the accidents which do occur ought not to occur, and that they are the result of carelessness and indifference on the part of both the employer and the employee. The community should insist on the recognition of accident and disease prevention as an employer's duty, and indifference to recognized methods of accident and disease prevention should be punished under the criminal law. Life and health in industry will certainly, in course of time, become matters of more serious importance than they are to-day, and those who recklessly and wilfully endanger the well-being of their workmen will be, as they ought to be, severely punished under the criminal law. When the community is awakened to its responsibility and insists upon the prevention of accidents and industrial diseases as a duty, and when it realizes the social necessity of reasonable and rational compensation of injured workmen as a right, the ultimate effect will be of vast benefit to the nation as a whole and the United States will then be placed on a par with the other civilized nations of the world.

TABLE I.

NUMBER AND PER CENT. OF DEATHS FROM ACCIDENTS AMONG MALES AND FEMALES FIFTEEN YEARS OF AGE OR OVER, IN THE REGISTRATION AREA OF THE UNITED STATES, BY CAUSES, 1900–07.

(Compiled from the Reports of the Bureau of the Census on "Mortality." Persons whose Age was not reported have been excluded.)

Cause of Death.	Males.		Females.	
	Number.	Per Cent.	Number.	Per Cent.
Burns and scalds	4,316	2.8	6,802	18.2
Drowning	19,043	12.4	1,607	4.3
Fractures, dislocations	13,365	8.7	6,394	17.2
Gunshot	6,369	4.2	774	2.1
Machinery	2,958	1.9	53	0.1
Mines, quarries	5,298	3.5	6	0.0
Poisoning, by gases	5,754	3.8	3,197	8.6
Poisoning, other causes	4,776	3.1	3,233	8.7
Railroad	38,372	25.1	2,821	7.6
Suffocation	1,115	0.7	275	0.7
Sunstroke	4,464	2.9	2,077	5.6
Vehicles, horses	5,587	3.7	568	1.5
All other causes	41,711	27.2	9,470	25.4
Total	153,128	100.0	37,277	100.0

TABLE II.

NUMBER AND PER CENT. OF INDUSTRIAL ACCIDENTS IN THE UNITED KINGDOM TO PERSONS OF EACH SEX EIGHTEEN YEARS OF AGE OR OVER, BY DEGREE OF INJURY, FOR THE PERIOD 1895–1908.

(Compiled from Annual Reports of the Chief Inspector of Factories and Workshops of the United Kingdom, 1895–1908.)

Degree of Accidental Injury.	Accident to			
	Males.		Females.	
	Total.	Per Cent.	Total.	Per Cent.
Fatal	11,392	4.4	158	0.5
Non-fatal:				
Loss of right hand or arm	685	0.3	80	0.3
Loss of left hand or arm	596	0.2	52	0.2
Loss of part of right hand	11,155	4.4	2,015	6.7
Loss of part of left hand	11,757	4.6	1,414	4.7
Loss of any part of leg or foot	1,051	0.4	14	0.1
Fracture of limbs or bones of trunk	7,458	2.9	471	1.6
Fracture of hand or foot	5,865	2.3	714	2.4
Loss of sight of one or both eyes	560	0.2	118	0.4
Injuries to head and face	25,053	9.8	2,883	9.7
Burns and scalds	35,274	13.8	1,022	3.4
Lacerations, contusions, etc.	145,383	56.7	20,867	70.0
Total non-fatal	244,837	95.6	29,650	99.5
Total fatal and non-fatal	256,229	100.0	29,808	100.0

TABLE III.

NUMBER AND PER CENT. OF FATAL AND NON-FATAL ACCIDENTS IN THE INDUSTRIES OF NEW YORK STATE, BY CAUSES, 1901–07.

(*Compiled from the Annual Reports of the New York Bureau of Factory Inspection*, 1901–07.)

Causes.	Fatal Accidents.		Non-fatal Accidents.		Total Accidents.	
	Number.	Per Cent.	Number.	Per Cent.	Number.	Per Cent.
Gearing, belts, shafting, pulleys, etc.	224	15.4	4,573	6.5	4,797	6.6
Elevators, hoists, cranes, etc.	315	21.6	5,219	7.4	5,534	7.7
Saws, planes, lathes	58	4.0	5,277	7.4	5,335	7.4
Presses, stamping machines	7	0.5	3,892	5.5	3,899	5.4
Emery wheels and buffers	12	0.8	1,590	2.2	1,602	2.2
Textile machinery	8	0.5	2,611	3.7	2,619	3.6
Other machines and machine tools	99	6.8	12,856	18.2	12,955	18.0
Total machinery	723	49.6	36,018	50.9	36,741	50.9
Hand tools (axes, saws, hammers)	—	—	2,894	4.1	2,894	4.0
Explosives	82	5.6	552	0.8	634	0.9
Hot liquids, acids, steam, etc.	134	9.2	3,219	4.6	3,353	4.6
Collapse of buildings and falling objects.	144	9.9	5,616	7.9	5,760	8.0
Fall of persons	129	8.8	4,790	6.8	4,919	6.8
Handling of merchandise	49	3.3	7,609	10.8	7,658	10.6
Vehicles and animals	76	5.2	1,990	2.8	2,066	2.9
All other causes	122	8.4	8,032	11.3	8,154	11.3
Total other than machinery	736	50.4	34,702	49.1	35,438	49.1
Grand total	1,459	100.0	70,720	100.0	72,179	100.0

TABLE IV.

NUMBER AND PER CENT. OF INDUSTRIAL ACCIDENTS IN NEW YORK STATE, BY DEGREE OF INJURY, DECEMBER 1, 1900, TO JUNE 30, 1909.

(*Compiled from the Reports of the New York Bureau of Factory Inspection*, 1901–09.)

Degree of Accidental Injury.	Accidents Reported.	
	Number.	Per Cent.
Temporary disablement:		
Lacerations	15,198	17.9
Burns	5,991	7.0
Cuts, etc.	12,946	15.2
Bruises	14,947	17.6
Sprains and dislocations	3,522	4.1
Fractures	3,735	4.4
Other injuries	9,590	11.3
Total temporary disablement	65,929	77.5
Permanent disablement:		
Partial or complete loss of eyes	362	0.4
Partial or complete loss of limbs	270	0.3
Partial or complete loss of hands or feet	357	0.4
Internal injuries	535	0.6
Other injuries	15,931	18.7
Total permanent disablement	17,453	20.4
Degree of injury not stated	81	0.1
Fatal accidents	1,663	2.0
Total accidents of all degrees	85,126	100.0

TABLE V.

INDUSTRIAL ACCIDENTS IN WISCONSIN, 1906–08.

Years.	Total Number of Accidents Reported.	Accidents to Employees while at Work.	Per Cent. of Accidents to Employees.
1906–07	13,572	7,186	52.9
1907–08	10,392	5,003	48.1

TABLE VI.

FATAL AND NON-FATAL ACCIDENTS TO EMPLOYEES, WISCONSIN, 1907–08.

Degree of Accidental Injury.	Number.	Per Cent.
Fatal	135	2.7
Permanent	574	11.5
Temporary	4,141	82.8
Not stated	153	3.0
Total	5,003	100.0

TABLE VII.

FATAL INDUSTRIAL ACCIDENTS BY AGE (MALES), WISCONSIN, 1907–08.

Age.	Number.	Per Cent.
10–15	3	2.22
16–24	39	28.89
25–44	51	37.78
45–64	33	24.44
65–	9	6.67
Total	135	100.00

TABLE VIII.

DURATION OF INCAPACITY, WISCONSIN, 1906–08.

Probable Duration of Injury.	1906–07.		1907–08.	
	Number.	Per Cent.	Number.	Per Cent.
Not over two weeks	1,520	21.1	1,618	32.4
Over two weeks, not over one month	3,481	48.4	2,129	42.6
Over one month, not over two months	1,019	14.2	749	14.9
Over two months, not over three months,	244	3.4	180	3.6
Over three months, not over six months	122	1.7	85	1.7
Over six months	25	.4	11	.2
Fatal	204	2.8	135	2.7
Duration not predicted	571	7.9	96	1.9
Total	7,186	100.0	5,003	100.0

TABLE IX.

METHOD OF INJURY IN INDUSTRIAL ACCIDENTS, WISCONSIN AND NEW YORK.

Causes.	Wisconsin, Year ending June 30, 1908.		New York, Year ending Sept. 30, 1907.	
	Number.	Per Cent.	Number.	Per Cent.
Mechanical power	1,679	33.56	9,046	46.56
Heat and electricity	304	6.07	1,580	8.13
Fall of person	684	13.67	1,535	7.90
Injured by weights	1,097	21.93	4,114	21.17
Flying objects	173	3.46	742	3.82
Vehicles and animals	171	3.42	423	2.17
Miscellaneous	895	17.89	1,991	10.25
Total	5,003	100.00	19,431	100.00

TABLE X.

FATAL ACCIDENTS TO RAILROAD EMPLOYEES IN THE UNITED STATES.

Years.	Number Employees.	Number Killed.	Fatal Accident Rate per 1,000 Employees.
1893	873,602	2,727	3.12
1894	779,608	1,823	2.34
1895	785,034	1,811	2.31
1896	826,620	1,861	2.25
1897	823,476	1,693	2.06
1898	874,558	1,958	2.24
1899	928,924	2,210	2.38
1900	1,017,653	2,550	2.51
1901	1,071,169	2,675	2.50
1902	1,189,315	2,969	2.50
1903	1,312,537	3,606	2.75
1904	1,296,121	3,632	2.80
1905	1,382,196	3,361	2.43
1906	1,521,355	3,929	2.58
1907	1,672,074	4,534	2.71
1893–97	4,088,340	9,915	2.43
1898–02	5,081,619	12,362	2.43
1903–07	7,184,283	19,062	2.65
1893–1907	16,354,242	41,339	2.53

TABLE XI.

FATAL ACCIDENTS TO BITUMINOUS COAL MINERS, UNITED STATES.

Years.	Number Employees.	Number Killed.	Fatal Accident Rate per 1,000 Employees.
1894	237,599	501	2.11
1895	243,227	617	2.54
1896	243,439	601	2.47
1897	248,268	511	2.06
1898	255,705	624	2.44
1899	267,440	756	2.83
1900	307,825	1,054	3.42
1901	335,279	971	2.90
1902	365,229	1,376	3.77
1903	407,027	1,211	2.98
1904	421,236	1,367	3.25
1905	454,081	1,515	3.34
1906	475,086	1,478	3.11
1907	486,717	2,038	4.19
1908	485,254	1,951	4.02
1894–98	1,228,238	2,854	2.32
1899–03	1,682,800	5,368	3.19
1904–08	2,322,374	8,349	3.60
1894–1908	5,233,412	16,571	3.17

TABLE XII.

FATAL ACCIDENTS TO ANTHRACITE COAL MINERS, PENNSYLVANIA.

Years.	Number Employees.	Number Killed.	Fatal Accident Rate per 1,000 Employees.
1894	139,655	439	3.14
1895	143,605	421	2.93
1896	149,670	502	3.35
1897	149,557	423	2.83
1898	142,420	411	2.89
1899	140,583	461	3.28
1900	143,826	411	2.86
1901	147,651	513	3.47
1902	148,141	300	2.03
1903	151,827	518	3.41
1904	161,330	595	3.69
1905	168,254	644	3.83
1906	166,175	557	3.35
1907	168,774	708	4.19
1908	174,503	678	3.89
1894–98	724,907	2,196	3.03
1899–03	732,028	2,203	3.01
1904–08	839,036	3,182	3.79
1894–1908	2,295,971	7,581	3.30

TABLE XIII.

EMPLOYERS' LIABILITY IN THE UNITED STATES, 1887–1908.

Years.	Premiums.	Losses.	Percentage of Losses to Premiums.
1887	203,132	32,924	16.21
1888	357,426	104,803	29.32
1889	628,017	180,045	28.67
1890	851,681	378,998	44.50
1891	2,126,286	755,720	35.54
1892	3,925,429	1,725,313	43.95
1893	1,788,178	798,589	44.66
1894	2,884,790	1,211,427	41.99
1895	4,002,140	2,090,523	52.23
1896	4,205,902	2,296,114	54.59
1897	4,375,447	2,152,653	58.20
1898	5,067,389	2,333,602	46.10
1899	6,052,901	2,571,532	42.48
1900	7,129,414	2,758,122	38.69
1901	8,328,834	3,321,697	39.88
1902	11,538,635	3,962,010	34.34
1903	13,613,881	4,838,798	35.54
1904	14,423,684	4,838,798	33.55
1905	15,767,818	5,272,664	33.44
1906	18,748,949	8,440,933	45.02
1907	21,999,792*	9,479,238*	43.09*
1908	27,938,311	10,052,125*	35.98*

* The statistics for 1907 and 1908 have been compiled from returns in The Spectator Year Books for 1908 and 1909. The statistics for the period 1887 to 1906 are from the reports of the New York State Insurance Department.

TABLE XIV.

EMPLOYERS' LIABILITY INSURANCE,* PERCENTAGE OF LOSS TO PREMIUM INCOME.

Company.	1899–1903.	1904–08.
Ætna	56.49	41.35
American Fidelity	—	18.92
American Mutual	61.80	39.65
Casualty Company of America	—	32.24
Contractors' Mutual	—	7.16
Employers	53.38	32.97
Fidelity and Casualty	57.44	36.20
Frankfort	60.50	36.84
General Accident	31.55	35.52
London Guarantee	56.23	32.34
Maryland	58.40	35.04
New Amsterdam	57.00	30.83
Norwich and London	—	12.73
Ocean	52.98	38.80
Standard	46.60	33.17
Travelers	55.87	32.94
United States	46.53	34.21

* The *Spectator*, Oct. 29, 1908.

TABLE XV.

EMPLOYERS' LIABILITY INSURANCE, EXPERIENCE IN THE UNITED STATES,* 1889–1903

(From Monthly Bulletin of the Fidelity and Casualty Company, September, 1906.)

Embraces the Experience in the United States in All the Various Classes of Industries.

Years.	Wage Expenditure.	Number of Accidents reported.	Accidents per $100,000 of Wages.
1889	$36,714,928	1,254	34.15
1890	81,799,402	3,934	4.81
1891	92,999,412	6,003	6.46
1892	112,699,535	7,894	7.00
1893	118,534,441	7,002	5.91
1894	126,196,480	9,995	7.92
1895	137,935,889	12,475	9.04
1896	118,759,879	11,245	9.46
1897	134,812,370	14,088	10.40
1898	138,207,715	16,283	11.77
1899	137,197,766	15,583	11.36
1900	147,364,535	15,692	10.65
1901	164,765,607	19,001	11.53
1902	182,450,914	22,683	12.43
1903	175,076,525	21,956	12.54
Total	$1,905,515,398	185,088	9.71

* It is explained with reference to these statistics that:—

"It is important to remember that these figures cannot be absolutely relied upon. Some of the insured are exceedingly careful and report every accident, however trifling, to us: others report only the serious accidents. In the main, however, the one probably offsets the other. There is a tendency, it would seem, in the direction of reporting every accident. There are more accidents reported in recent years. This is due, without doubt, to greater care in reporting, and not to greater frequency of accidents."

TABLE XVI.

EMPLOYERS' LIABILITY INSURANCE, EXPERIENCE IN THE UNITED STATES, 1889–1903.

(From Monthly Bulletin of the Fidelity and Casualty Company, September, 1906.)

Embraces the Experience in the United States during the Years 1889–1903, *Inclusive.*

Classes of Industries.	Wage Expenditure.	Number of Accidents.	Number of Persons employed on Assumption of Average Annual Wages of $500	Proportion of Persons injured. 1 in	Accidents per $100,000 of Wages.
Bakers and confectioners	$35,620,283	1,729	71,240	41.20	4.86
Bridge builders	6,554,298	2,855	13,108	4.59	43.57
Carriage and wagon builders	17,558,322	1,180	35,110	29.75	6.72
Chemical and color works	69,557,839	5,587	139,115	24.89	8.03
Contractors	151,473,698	27,657	302,947	10.95	18.26
Electric light and power	26,631,740	3,749	53,263	14.20	14.08
Leather	64,117,232	2,420	108,254	44.73	3.77
Lumber	129,698,868	15,575	259,397	16.65	12.01
Metal works	377,064,010	44,723	754,128	16.86	11.86
Milling	14,471,238	675	28,942	42.87	4.66
Mining	115,264,632	11,225	230,529	20.53	9.73
Miscellaneous	190,763,263	14,755	381,526	25.85	7.74
Oil	12,081,597	1,516	24,163	15.93	12.55
Ore reduction	28,025,226	2,574	56,050	21.77	9.18
Paper	55,382,868	4,505	110,765	24.61	8.14
Pottery	53,681,734	2,422	107,363	44.32	4.51
Printing	54,884,422	1,996	109,768	55.04	3.63
Quarries and stone-cutters	42,387,902	3,433	84,775	24.69	8.10
Stamping	7,174,327	2,024	14,348	7.08	28.22
Stevedores and steamships	50,365,638	7,795	100,731	12.91	11.88
Textile	222,560,852	7,579	445,121	58.73	3.41
Warehouses and stores	47,788,370	1,888	95,576	50.62	3.95
Wood	129,072,020	15,868	258,144	16.27	12.29
Special risks	3,335,019	1,358	6,670	49.11	40.75
Total	$1,905,515,398	185,088	3,811,030	20.59	9.71

TABLE XVII.

WORKMEN'S COMPENSATION STATISTICS, GREAT BRITAIN, 1908.

Industry.	Number employed.	Fatal Accidents.		Disablement Cases.	
		Number.	Rate per 1,000 Employees.	Number.	Rate per 1,000 Employees.
Shipping	235,001	371	1.58	5,877	25.01
Factories	5,497,988	951	0.17	136,357	24.80
Docks	67,929	156	2.30	10,591	155.91
Mines	1,047,862	1,301	1.24	137,622	131.34
Quarries	85,475	88	1.03	5,284	61.82
Construction work	127,106	119	0.94	6,805	53.54
Railways	451,392	461	1.02	20,688	45.83
Total	7,512,753	3,447	0.46	323,224	43.02

TABLE XVIII.

WORKMEN'S COMPENSATION STATISTICS, GREAT BRITAIN, 1908.

Industry.	Fatal Cases.			Disablement Cases.		
	Number Cases.	Total Compensation.	Average Compensation.	Number Cases.	Total Compensation.	Average Compensation.
Shipping	371	$298,446	$804.44	5,877	$250,691	$42.66
Factories	951	635,042	667.76	136,357	3,213,025	23.56
Docks	156	103,422	662.96	10,591	317,361	29.97
Mines	1,301	1,100,816	846.13	137,622	2,928,592	21.28
Quarries	88	55,964	635.95	5,284	112,190	21.23
Constructional work	119	65,939	554.11	6,805	186,217	27.36
Railways	461	329,501	714.75	20,688	404,262	19.54
Total	3,447	$2,589,130	$751.13	323,224	$7,412,338	$22.93

TABLE XIX.

COMPARATIVE FATAL ACCIDENT RATES IN HAZARDOUS OCCUPATIONS IN THE UNITED STATES.

Occupations.	Period.	Number of Employees.	Number Killed.	Rate per 1,000 Employees.
Fishermen (Gloucester fisheries)	1897–1906	44,145	516	11.69
Railway trainmen	1898–1907	2,351,295	17,924	7.62
Coal miners (Colorado	1899–1908	103,832	635	6.12
Iron miners, inside (Dickinson Co., Mich.)	1897–1906	22,405	111	4.95
Iron miners (Marquette Co., Mich.)	1899–1908	56,030	243	4.34
Railroad switch-tenders, crossing-tenders, and watchmen	1898–1907	489,492	2,126	4.34
Coal miners, anthracite (Pennsylvania)	1899–1908	1,571,064	5,385	3.43
Coal miners, bituminous (United States)	1899–1908	4,005,174	13,717	3.42
Lead and zinc miners (Missouri)	1898–1907	119,296	359	3.01
Metal miners (Colorado)	1897–1906	347,856	990	2.85
Copper miners (Houghton Co., Mich.)	1894–1903	110,241	309	2.80
Coal miners (Illinois)	1899–1908	508,089	1,383	2.72
Iron miners, outside (Dickinson Co., Mich.)	1897–1906	9,475	24	2.53
Coal miners (Missouri)	1899–1908	89,182	122	1.37
Railway mail clerks	1897–1906	98,077	111	1.13
United States Life Saving Service	1897–1906	19,992	17	0.85

PROCEEDINGS OF THE QUARTERLY MEETING OF THE AMERICAN STATISTICAL ASSOCIATION, WASHINGTON, D.C., SEPTEMBER 24, 1909.

A regular quarterly meeting of this Association was held at the Ebbitt House, Washington, D.C., at 6 P.M., Friday, September 24. The meeting consisted of a brief informal reception, followed by a dinner at which sixty-eight members and guests were present. Harry T. Newcomb presided at the post-prandial exercises. Addresses were delivered by Hon. E. Dana Durand, Director of the Census, and Dr. Cressy L. Wilbur, Chief Statistician of the Division of Vital Statistics, Bureau of the Census. In accordance with the custom of the Association the papers were freely discussed by several of the members and guests.

At the close of the discussion of the papers it was voted to hold another meeting of the Association at the same place on October 25 following, and to extend an invitation to the members of the American Public Health Association and of the Association of American Government Accountants. The following committee was appointed to have charge of the arrangements: E. Dana Durand, Charles S. Sloane, George K. Holmes, Cressy L. Wilbur, and Jean P. Muller.

The meeting then adjourned.

CARROLL W. DOTEN, *Secretary.*

INTRODUCTORY REMARKS.

By H. T. Newcomb.

It is naturally a memorable moment in the history of a reformed statistician when he is permitted to call to order a gathering composed of the leading active workers in the fields from which he has departed in order to lead a different life. I therefore thank you for the honor conferred in permitting me to preside on this notable occasion.

The purposes of the American Statistical Association, as I understand them, are to encourage the use and perfect the processes of a scientific method of study that is, perhaps, especially applicable, and certainly has been most extensively used in connection with the social sciences. These purposes are eminently practical, and it is an eminently practical incident of their execution that there should be frequent meetings of the Association in the city of Washington. For Washington is the scene of a greater amount of statistical activity than any other city in the world, and holds a very large number of the ablest and most experienced workers in statistics.

Both the American Statistical Association and these workers have much to gain by the comparison of methods and ideals for which such meetings as this afford opportunity. Every statistical worker ought to look upon a membership in the Association as both an honor and an opportunity, — an honor on account of its history and associations, an opportunity on account of its potential service to him and the services which he can render through the Association to his coworkers in statistics.

The Association was organized in 1839, the year which saw the beginning of the series of publications of the Royal Statistical Society. From the beginning its list of members has included many of the most honored names among American students of social conditions, and for a long time its member-

ship has been actually international. Its publications are now sent regularly to members in substantially every State of the Union and in most of the civilized nations of the world. These publications, issued continuously during a period of twenty-two years, cover a wide range of inquiry, and are valuable and practical contributions to our knowledge of social conditions.

This occasion cannot be allowed to pass without a pause of affectionate respect for two of the distinguished Presidents of the Association, both of whom earnestly wished to see the Association strong and active in Washington. Some ten or twelve years ago, when the first meeting in this city was held, General Francis A. Walker came here especially to aid and encourage our undertaking, and Colonel Carroll D. Wright was, of course, the leader, without whose support we would not have ventured to proceed. Each of these great men served long in turn as President of the Association, and each was for many years the unquestioned leader of statistical work at the nation's capital.

Francis A. Walker, soldier, scholar, statesman, and statistician, so far outranks his predecessors in the field of statistics as to seem its first really great figure. He planned and executed the first satisfactorily comprehensive decennial census and first gave a really scientific character to national statistical activity. He was the ideal American citizen, and the wide range of his services and achievements has scarcely a parallel.

In Carroll D. Wright, General Walker had a worthy successor. Colonel Wright had been a capable soldier, a wise and efficient legislator, before his exceptional service at the head of the Massachusetts Bureau of Statistics of Labor made his selection as the first Federal Commissioner of Labor so plain a duty that an out-going Republican President and his Democratic successor agreed that no other name ought to be considered. It would be superfluous to speak on this occasion of the immensity of his contribution to statistics, for I am but the least in this gathering in capacity to estimate its value. He was an unfailing inspiration to those of us who worked in statistics in Washington during his service here. His door was

always open to those who sought counsel concerning their work, he made their problems his own, his suggestions were generous and helpful, his good-nature was unfailing. To have enjoyed such an association and to have shared some of the hours not given to labor, when his genial nature, his breadth and warmth of sympathy, and his keen and kindly humor brought into view another phase of his manly and exalted character, I shall always regard as among the highest of privileges.

But we turn from the past, characterized by great men and brilliant achievements, to a present full of promise. The direction of great statistical undertakings is full of exhausting labor, and requires the strength and initiative of young men. The great men of whom I have spoken came to their own while very young as compared with men called to equal responsibilities and prominence in other fields. Other young men have been called to fill the places which they filled, and have taken up their labors with equal devotion to duty, with purposes equally noble, and, we believe, with equal promise of successful achievement. Their labors are so linked to a great past that they cannot choose but to strive greatly. It will be our pleasure to listen this evening to statements of the plans and purposes of some of the best qualified among them.

CENSUS METHODS.

By Hon. E. Dana Durand, Director of the Census.

Accuracy is the fundamental requirement of all statistical work. This means, first, accuracy in collecting the original material; second, accuracy in compiling and tabulating it; and, third, accuracy in analyzing and interpreting it. The first and third stages in the process of statistical work are extremely difficult, and it is concerning these that I wish especially to speak. It is a matter of comparative simplicity to secure accuracy in compiling and tabulating statistics. The principal problem here is to secure economy of time and money. A few words only as to the methods of compilation and tabulation contemplated for the coming census will be sufficient.

Methods of Tabulation.

The population census of 1910, like that of 1900, will be tabulated by the use of punched cards. Every person in the United States is given a card on which the facts with regard to sex, race, age, birthplace, birthplace of parents, and the like are indicated by the punching of appropriate holes. The number of persons possessing each specific characteristic or combination of characteristics which it is desired to show in the final tables is then counted by means of electrical tabulating machinery, electrical contacts being made through the holes punched in the cards.

The punching machines to be used at the present census differ very radically from those used before, and will, it is believed, not only increase the rapidity of the work, but tend to reduce the number of errors on the part of the clerks doing the punching. With the old punching machine, if an error was made in a single item,—even though it might be the last item to be punched on the card,—the entire card had to be destroyed.

This consumed time, and also resulted in a tempation to the operator to let the error go uncorrected. With the machines now to be used, no hole is punched in the card until the keys for all the facts to be punched have been set, and, if the operator makes a mistake by depressing the wrong key, he can correct it before the card is punched. It was not found possible at the last census to check all of the cards back to the schedules, and it will probably not be feasible to do so at this census. Part of the cards punched by each operator are selected at random and compared back, and, if any appreciable percentage of error is discovered in those thus compared, the other cards punched by the same operator are likewise compared.

The tabulating machines to be used at the present census will likewise result, it is believed, in a material increase of rapidity and reduction of errors. This is principally brought about by the fact that the results of the count for each unit of area are automatically printed, whereas formerly they were registered on dials from which readings had to be taken and recorded by hand. The reading of these dials took a large amount of time, during which the machine was idle, and inaccurate readings were not uncommon.

The Margin of Error.

Turning now to the more important subject of the means of securing accuracy in the original census returns collected in the field, it is self-evident that the entire value of the census depends on the securing of approximate accuracy in the original returns. Absolute accuracy is out of the question, and, in fact, a small margin of error does not seriously affect the value of the statistics; but any considerable margin of error practically destroys their value. No degree of accuracy in tabulating and no degree of skill and judgment in analyzing statistics can give value to data which were incorrect in the first place.

It has too often been a vice of statisticians to present to the public tables purporting to show all sorts of important facts without due consideration of their truthfulness. The general

public who use the statistics—in fact, even the trained statisticians who use them—have in most cases no means of discovering the inaccuracy of such statistics and go on using them in misguided confidence. The compiler of statistics has often been, unconsciously perhaps, careless as to their accuracy because of the lack of any possibility of detection. The man who has charge of the collection of statistical data ought himself to be the severe and uncompromising critic of those data. He alone has approximately adequate means of judging the degree of accuracy which has been secured; and it is his duty, having done all that is possible to eliminate error, to inform the public fully and frankly of the extent to which error presumably still persists. So far from taking advantage of the fact that others cannot discover the errors which are hidden away in imposing-looking totals, he should from that very fact recognize the more clearly his own duty to explain just how much or how little the statistics may be trusted.

This does not mean, of course, that the statistician who knows that there are certain errors in his figures should straightway declare them of no value. Statistics on certain subjects may be of very little value unless almost absolute accuracy is secured, but there are many subjects as to which close approximations to the truth are almost as valuable as the exact truth itself. It is the mark of the competent statistician to be able to decide approximately what the margin of error actually is, and also to what extent the error vitiates the results. As Josh Billings said, "It is better not to know so much than to know too many things what ain't so."

At the census of 1900 and during the so-called intercensal period since that time the Census Bureau has done a great deal in the way of criticising its own statistics in the manner I have suggested; but I doubt whether it has yet been sufficiently emphatic in cautioning the public with respect to the existence of unavoidable errors. As one means of expressing the approximate character of the data, I think it desirable to express all very large totals of manufacturing and agricultural statistics in millions, and, in the case of the smaller figures

which appear in the statistics for individual localities and industries, to express the results in thousands.

To criticise statistics, however, is easy: the difficult task is to improve them. The Census Bureau will have done part of its duty to the public if it gives warning regarding the margin of error in the statistics it publishes, but it is far more important that it should reduce that margin of error.

Method of Selecting Field Force.

There are two means to this end. The first and more difficult is to secure better men to collect the statistics: the second is to simplify and clarify the inquiries.

As you are aware, the statistics of population and of agriculture are collected by a different force from that employed in gathering the statistics of manufactures. The population and agricultural data are secured by enumerators, of whom there will be about sixty-five thousand at the present census, they in turn being appointed by the supervisors, of whom there are about three hundred and thirty. The difficulty of securing competent and faithful enumerators is very great. The length of service is short, fifteen days in the cities and thirty days in the country districts. The period is thus too short to justify a man who has a good job in quitting it, while, on the other hand, it is too long in most cases to enable such men to get leave from their regular work to take the census. Moreover, the pay is small, averaging perhaps $3 per day in the country districts and a trifle more in the cities,—practically the pay of ordinary mechanics. Most of those who seek, from financial motives, to be enumerators are men who are able to command only moderate pay in their occupations, while many of them are men who cannot command regular employment and who are looking for odd jobs.

Consideration has been given by the census authorities from time to time to the plan pursued in Germany and some other European countries, by which the census is taken chiefly or wholly by men serving without pay, who either volunteer

their services from patriotic motives or who are required to act. I very much doubt whether conditions in this country are ripe for such a scheme. At any rate, nothing of this sort can be done at the present census. It may, however, be hoped that to some slight extent, and possibly to a considerable extent, men can be induced to accept the position of enumerator from interest in the work rather than for the compensation involved. I hope that a considerable number of the colleges and universities of the country may see fit to give leave of absence to their students for the short time required to do this work of enumeration. It is, however, usually desirable that enumerators should actually live in the districts where they work, and there are multitudes of districts where no college students reside or where such students are in institutions hundreds or thousands of miles from their homes. Another class who can render good service as enumerators are school-teachers, but, with the enumeration taking place in April and May instead of June as formerly, few school-teachers can be spared from their duties to take the census.

The primary responsibility for securing efficient enumerators must rest with the supervisors of the census. It has been suggested from time to time that more efficient enumerators might be secured by competitive civil service examination. The difficulty with such an examination is the expense and delay involved. It is probable that for the sixty-five thousand places there would be several hundred thousand candidates, and the grading of their papers would require a large force for a long time. At some future census this plan might be worth a trial, but it can scarcely be attempted at the present census within the limits of time and appropriations set by law.

The Census Bureau does, of course, undertake to protect itself against such obviously incompetent enumerators as the supervisors, through political influence or through oversight, may happen to choose. At the last census the enumerators recommended by the supervisors were all subjected to a test examination, and the same policy will be pursued this time.

About one-sixth of the candidates selected by the supervisors were rejected as the result of this test in 1900.

I hope and believe that the supervisors at the present census are, on the whole, a higher type of men than those at any preceding census. The compensation offered to supervisors is somewhat more than ever before, but it is not really an adequate remuneration for men of the character needed. I believe that a very considerable proportion of the supervisors who have been appointed are men who in their regular occupations or professions are able to earn much more than the supervisors' pay, and who have accepted the positions because of the honor and responsibility involved or from patriotic motives. There has, however, been no new departure with respect to the general method of selecting supervisors, save only that in most of the large cities, selections have been made independently of political recommendations.

It may not be inappropriate here to explain the reason why so-called political recommendations must be sought in the appointment of supervisors in most of the districts. The supervisor, in order to do his work properly, must be a resident of the district over which he has charge. The position is not one which can be filled by civil service examination. A supervisor should be a man of executive ability, such as no examination can test, and he should be a man well known in his community. Indeed, men of the type desired would not in most instances be willing to submit themselves to a civil service examination. Neither the Director of the Census, his superior officer, the Secretary of Commerce and Labor, nor the President, can possibly have personal acquaintance throughout the country with men suitable to fill these positions, nor even with men, outside of political positions, whose advice they can seek. The representative of the district in Congress or the party leaders in the district have the necessary knowledge of local conditions and local men, and it is not only natural, but practically necessary, as a matter of good administration, that they should be asked to make recommendations for positions of this character.

Fortunately, members of Congress and party leaders are coming more and more to appreciate the importance of accurate census statistics. The spoils idea of appointments is growing constantly less dominant. The Director of the Census has done everything possible to impress upon those whose opinions were asked regarding the supervisorships the importance of the work and the necessity of having men of marked executive ability and of absolute integrity. The information furnished by members of Congress and party leaders regarding the candidates whom they have recommended has been supplemented by full personal statements required from each candidate, and in most cases by numerous letters of indorsement from business and professional men.

In the large cities the administration is evidently less dependent than in the country districts upon members of Congress and party leaders for information regarding available material for such positions as that of supervisor of the census, and the President and the Secretary of Commerce and Labor have joined with the Director of the Census in establishing the policy of making selections, wherever the information on which to act was available, without depending on the recommendations of political leaders.

The work of collecting statistics of manufactures and mining is in some respects even more difficult than that of collecting population and agricultural statistics. The number of employees required, however, is much more limited, and consequently it is possible to employ more elaborate methods of selecting them. The manufactures and mining statistics are practically all collected by men known as special agents. These are appointed by the Director, and the law does not require any examination, but it is my intention, nevertheless, to make the appointments as the result of competitive examination, held on November 3, from which, however, men who have had previous successful experience in field work for the Census Bureau will be excused, as well as men who have successfully passed the somewhat similar examination for the position of special agent in the Bureau of Corporations. It is evident that an ordinary civil

service examination, with its tests merely of what a man knows, is not adequate for the selection of men to do the responsible and largely independent work of visiting manufacturing and mining establishments to secure schedules from them. Consequently, following a precedent set by the Bureau of Corporations and to some extent employed also in other more advanced scientific civil service examinations, the examination for special agents consisted in part of the presentation of evidence regarding the applicant's previous education and experience, while the remainder of the examination was a very practical test of his ability to fill out a manufactures schedule. For those who are to do the simpler field work, this test was little more than reproducing on a schedule a set of facts which have been stated in narrative form, but, for the agents who are to visit the more important establishments or who are to have charge of other agents, the test consisted of the filling of a schedule from somewhat complicated details in a hypothetical balance sheet, income account, and pay-roll. Moreover, not being bound by any legal requirement to take the man with the highest rating first, the appointing officers of the Bureau will be able to give proper attention to such matters as personal address and tactfulness, which cannot be tested by any examination. We hope to secure as special agents largely young college and university men with some training in economics and statistics, or men who have been book-keepers of the more advanced type in manufacturing establishments or who have had other direct business experience.

Preparation of Schedules.

The form of the schedules on which census statistics are collected has an extremely important bearing upon the accuracy of the results obtained. In the drafting of a schedule, the first consideration is naturally what information it is desired to secure, but it is equally important to consider how far it is possible to obtain information accurately. There are always abundant suggestions from people interested in different eco-

nomic and social problems as to points which ought to be included in the schedules, and there is comparatively little danger that a statistician in public office will neglect to make inquiries merely because he does not know that the information would be of utility to the public. There are not so many people, however, who are well informed as to the difficulties of securing statistical facts; and one of the most important tasks of the statistician is to determine what facts can be secured with accuracy by the means which he has at his disposal. Not only are some inquiries, which, if answered correctly, would furnish very valuable information, in themselves quite incapable of correct answer under existing conditions, but the multiplication of inquiries which separately are quite capable of accurate answer tends to lessen the accuracy of the replies to all of them. A schedule may, in other words, easily be overloaded. The enumerator or special agent collecting the statistics becomes discouraged if too much is asked of him, and the person to whom he addresses his inquiries becomes still more discouraged, not to say annoyed and confused.

Every reduction in the number of inquiries contained in a census schedule tends to greater accuracy in the returns, except of course in those cases where such reduction in the number of inquiries injures the clearness of the schedule. Some details in schedules, themselves comparatively unimportant, are often necessary in order to make clear what is intended to be included in a total.

This demand for reduction of the number of inquiries and simplification of them, in the interest of accuracy in the returns themselves, is in some cases opposed by the likewise important demand for details which will permit an accurate analysis and interpretation of the statistics. In other words, the lower form of accuracy sometimes stands opposed to the higher form, which seeks the true spirit of the phenomena investigated. For example, take manufactures statistics. In many industries the entire technical and economic conditions are rapidly changing, and broad general interrogatories, even though answered with entire accuracy, give results

which are not comparable with those of preceding censuses because of such changes in conditions. One instance of this character happens to have come to my personal attention recently. The schedules for the petroleum industry call for the value of the different kinds of oils produced, including the containers in which they are shipped from the refineries. Twenty or thirty years ago nearly all oil was shipped from refineries in barrels or other small containers, the value of which represented a large fraction of the total value of the product. At the present time the larger part of the products of refining is handled in bulk, without containers. A comparison of the average value computed by dividing the number of gallons into the total value of the product, including containers, from one census period to another, is, therefore, highly misleading. The higher form of statistical accuracy would be secured only by the insertion of somewhat burdensome questions, designed to separate the value of the product contained from that of the containers.

It is evident, therefore, that it is an exceedingly important and difficult task to frame a schedule which shall combine simplicity with that completeness which will permit correct interpretation.

The manufactures, mining, and agricultural schedules are necessarily the most complicated which the Census Office employs. The office has spent a very large amount of effort during the present summer in studying these schedules, and has called to its assistance a number of economists and statisticians from the universities, as well as men connected with the practical work of the Department of Agriculture and the Geological Survey and men actively engaged in business. I hope that we are succeeding in materially reducing the burden upon the enumerators and the special agents, while at the same time cutting out few inquiries of material value and adding some which will make the results more intelligible.

To illustrate what has been undertaken, I will call attention to two very material changes which have been made in the schedule of manufactures. At the censuses of 1900 and 1905

that schedule called for the average number of men, the average number of women, and the average number of children under sixteen employed during each month in each establishment. To answer this interrogatory with strict accuracy would have required the special agent or the manufacturer to go in detail through every pay-roll of the year, usually either fifty-two or twenty-six in number, counting the number of men, women, and children separately on each,—the segregation of those under sixteen involving peculiar difficulty,—and averaging the account for each month. To do this and at the same time to answer the inquiry regarding classified wages to which I will shortly refer would, in my opinion, have required ten times as much time as to answer all of the other inquiries on the schedule put together. As a matter of fact, practically none of the returns were, I am convinced, based on analysis of the pay-rolls. They were in nearly all cases mere estimates made more or less off-hand by the manufacturer or his book-keepers, and, as many months had elapsed before the estimates were made, there is every reason to believe that they were often very wide of the mark.

The schedule as it has been revised for the present census calls for the number of men, women, and children employed during one specific week only, and for the total number employed, without distinction of age or sex, on the fifteenth day of each month. The relative extent to which women and children are employed will be ascertained approximately from the figures for the selected week. If the total number of employees for one day of each month is returned with approximate accuracy, then the average of these twelve dates will unquestionably show very closely the true average number of employees during the year. We hope to be able to induce special agents and manufacturers in a large proportion of cases to answer this revised interrogatory from actual pay-rolls, and, if so, the greater accuracy will far outweigh any apparent sacrifice in the amount of information obtained.

At the last census of manufactures a question was included in the schedule which called for the number of employees classi-

fied according to their earnings for one week of the year, separating men, women, and children under sixteen. This is a question which, if correctly answered, would furnish information of very great value. We have become convinced, however, that for many establishments correct answers cannot be obtained, and that for other establishments the amount of effort required to obtain correct answers is so great as scarcely to justify the expense, while also tending to injure the accuracy of all the data called for on the schedule. Strictly speaking, this inquiry falls within the field of the Bureau of Labor rather than that of the Census Bureau. It may be, however, that at another census, in order to take advantage of the fact that census agents are to visit every manufacturing establishment, it would be desirable to ask the authority of Congress to provide a special schedule covering classified wages, and an extra appropriation to cover the expense of getting it properly filled from actual pay-rolls. It would not be essential that returns of classified wages be secured from every manufacturing establishment. If such returns could be secured accurately for even 50 per cent. of the employees, they would be of very great value, and the agents could be specifically instructed to accept no estimates whatever.

What has just been said regarding these two changes in the manufactures schedule will illustrate what I said before with regard to the increase in accuracy which can be secured by simplification of the schedules. The schedule of manufactures hitherto has been overloaded. Since special agents and the manufacturers who filled them were practically forced in many cases to make estimates in replying to the interrogatories regarding the average number of employees and classified wages, they were tempted to regard estimates as sufficient for the replies to all the interrogatories of the schedule. The intellectual integrity of the special agents was undermined by requiring of them work which they knew could not be done accurately within the time which they were allowed.

ANALYSIS AND INTERPRETATION OF STATISTICS.

It is a commonplace of statistical science that the mere presentation of figures has comparatively little value without analysis and interpretation.

The statistician owes to the public the duty of properly analyzing and interpreting his material, not simply in order that the public may get the full value of the results, but, what is more important, in order that false and misleading interpretations may be forestalled and prevented. Whether the untruthfulness has been due to intentional misrepresentation or to ignorance, census statistics have probably been made the basis of more fundamentally untruthful speeches and articles than any other set of facts. The reports of the Census Bureau in the past have contained many warnings against such misleading use of their contents, but such warnings are all too often disregarded. Liars and fools—to use perhaps exaggerated expressions—will continue to abuse census statistics, whatever the Government may do to prevent it. We shall attempt at the present census, however, to make the warnings against such use of the figures even more numerous and more emphatic than in the past, in order that the man of ordinary intelligence may in general escape the pitfalls. Too often the warning has been posted in an inconspicuous place, hidden away in some long page of text, when it should properly have been presented in the most conspicuous place in the text, or often in the headings of the tables themselves, since most people, even those of considerable economic training, usually pay little attention to the text and assume that the tables mean what on their face they purport to mean. These warnings should relate not merely to unwarranted conclusions from the figures, but also, where necessary, should caution the reader against assuming a degree of accuracy in the statistics which does not exist. One of the most important duties of the census statistician is, as I stated at the beginning, to discuss frankly and clearly the margin of error in the returns.

In addition to increasing the frequency and the emphasis

of the warnings against improper use of the census statistics, it will be desirable, in my opinion, to extend somewhat further than hitherto the analysis and interpretation of the statistics, at least in certain directions. A desirable feature of this increased analysis will be the publication of additional monographs dealing with particular economic and social problems. Many people have little interest in census statistics in general, but are profoundly interested in the data regarding some particular subject, and such data should be available for their use in separate form so far as possible. You will recall, for example, the exceedingly able monograph prepared by Dr. Willcox on the basis of the census of 1900 and dealing with the negro. We contemplate another monograph on this subject at the present census, and also similar monographs dealing with the foreign-born, with the family, with occupations, and perhaps with other similar subjects connected with the population statistics. Monographs dealing with particular branches of agriculture are also contemplated. The practice of presenting the statistics of the leading manufacturing and mining industries in monographic form has already been pursued quite generally at previous censuses.

Proper analysis and interpretation of the census statistics will call for the employment of a considerable number of statistical experts in addition to those on the permanent roll of the census. A considerable proportion of the tabular and text analysis and interpretation of the statistics at the previous censuses has been committed to men of comparatively little economic and statistical or business training and experience, although beyond question much of the work has been done by highly competent men. We hope to be able to enlist the service, for periods ranging from a few months to a year or two, of a considerable number of expert special agents to aid in the work of analyzing and interpreting the returns. Hitherto the limit of salary for temporary expert service of this sort has been altogether inadequate, $6 per day. In July of this year Congress passed a bill authorizing the payment of not to exceed $8 per day to twenty expert special agents. The Di-

rector had asked that the limit of pay be fixed at $10, and it is possible that Congress will this winter be again urged to establish that rate. Even $10 per day is but moderate compensation to offer to men who possess the necessary qualifications for this work, most of whom are already earning at least that much in permanent positions.

It is not the intention to employ exclusively men who have had university training in economics and statistics in this advanced work of analyzing and interpreting the census material. Particularly in the case of the manufacturing, mining, and agricultural statistics, it will be desirable to obtain the service of men of practical business experience. This policy has been pursued, in fact, to a considerable extent at previous censuses. I believe, however, that in some cases the economy as well as the scientific value of this work has been impaired by having too much of it done by men who were not actually present in Washington, but who gave only such time as they could spare from their regular professions or occupations to the work at their own homes, coming only occasionally to Washington for consultation. This practice has tended to undue lack of uniformity in methods, and has placed too great responsibility on single individuals. While specialization has its great advantages, it should be combined with consultation with others working on kindred topics.

The general policy of insisting that, for the most part at least, the expert special agents who analyze the statistics and prepare the text of the reports shall be present in Washington at least the greater part of the time, will in some cases exclude practical business men such as have formerly been employed for that purpose, because of their inability to give up, even temporarily, their regular duties. We shall, however, employ such men as consulting experts, having them come occasionally to Washington or sending the expert special agents who are assigned to particular tasks to consult with them at their homes. We believe that the undivided attention of men of high capacity and of general statistical and economic training, even though they may previously have had little direct experience in the

particular subject intrusted to their charge, will enable them in a comparatively short space of time to become sufficiently expert to handle the statistics even more satisfactorily than can be done by men of more practical experience who are not personally present and can give only a part of their time.

A STATISTICAL PILGRIMAGE.

By Cressy L. Wilbur, Chief Statistician, Division of Vital Statistics, Bureau of the Census.

It is usually expedient to commence at the beginning of a story or book in order to understand its contents, although it is not unusual for readers to turn to the last chapter to see how the story comes out.

I presume that you are especially interested in the recent statistical pilgrimage, if I may so call it, which I made as a representative of the Bureau of the Census to the International Commission of Revision of the Classification of Causes of Death at Paris last July. Nevertheless, if you will pardon me, I shall first say a few words about the first statistical pilgrimage that I ever undertook, because that is really the beginning of the last one.

My first journey abroad in search of statistical light was about fifteen years ago. I was then the chief of the Division of Vital Statistics of the State of Michigan, and had only been in the work of registration since Jan. 1, 1893. I appreciated the very serious defects of the old Michigan law, and naturally, as a physician, my attention was called to the very unsatisfactory character of the statistical classification of causes of death which had been in use in Michigan since the first operation of the law in 1867.

In a discussion of the subject with my friend Dr. Henry B. Baker, the veteran and honored secretary, at that time, and organizer of the Michigan State Board of Health, he suggested the desirability of my attendance upon the annual session of the American Public Health Association, of which he is one of the ex-presidents. I felt the necessity for consultation with other workers in vital statistics, and accordingly I determined to attend the meeting, which was held at Montreal, Province of Quebec. With the temerity characteristic of the medical

man who has just had his attention called to mortality statistics, I took with me a paper on the subject of a New Classification of Causes of Death, which I had the grace to entitle "A Provisional Arrangement."

At this meeting it was my great good fortune to meet, among many eminent leaders of sanitation and vital statistics in the United States, Dr. Charles A. Lindsley, secretary of the State Board of Health of Connecticut for many years, and of whom it was said that he could hear a death occur in any part of the state and detect whether it was registered or not; Dr. Benjamin Lee, former secretary of the State Board of Health of Pennsylvania and now honored in an advisory capacity with the Health Department of that state; Dr. J. N. McCormack and Dr. William Pailey, of Kentucky; Dr. C. O. Probst, of Ohio, now secretary of the Association, and whose active interest in vital statistics greatly promoted the passage of the excellent law which enabled Ohio to be included in the registration area during the present year; Dr. Bryce, the Provincial Health Officer and Registrar of the neighboring province of Ontario; and, eminent among them all from his high attainments and great practical knowledge of registration methods, Dr. Samuel W. Abbott, then secretary of the State Board of Health of Massachusetts. I well remember when Dr. Abbott and I sat on a bench in the park before the Windsor Hotel at Montreal and talked over the principles of the new classification which I had brought down for the consideration of the veteran registration officials. I first learned from him—he was then chairman of the Committee on Vital Statistics of the Association, and made a special report to the meeting on the subject—that a proposition for an International Classification of Causes of Death had been made by Dr. Jacques Bertillon, of Paris, at the meeting of the International Institute of Statistics, which was held at Chicago during the World's Fair of the previous year. I had been in Chicago at the time of the meeting of the International Statistical Institute, but, having been in the statistical service only a short time, I was quite uninformed as to the existence of such a body. I was

not to blame, and there are many young men placed in charge of registration work in the United States to-day who are quite ignorant that there is such an organization as the American Public Health Association, with its Section on Vital Statistics, or the American Statistical Association, and who therefore feel quite free to devise new forms and methods according to their own inclinations and to produce statistical reports which are chiefly remarkable for the absence of all possible comparability with any other reports. I am not saying that my new classification, which you will find in the Michigan reports for several years, beginning with 1892, was not a good one, and it was no objection to it at that time that it was peculiar to Michigan; for, as a matter of fact, there was no agreement between any two states or between any two countries of the world in the forms of presentation of mortality statistics relating to causes of death.

The situation was deplorable in this respect, because it is absolutely necessary to compare the statistics of causes of death of one country, state, or city with those of another, in order to know their relative condition with respect to sanitation and the proper enforcement of laws for the preservation of the public health. The whole science and practice of modern hygiene of the nation, state, and city, is based upon vital statistics; and, when the figures by which its progress is measured cannot be compared, the result is unfortunate for the full success of the methods employed for the protection of the lives of the people.

The visit to Montreal and the intercourse with representatives from other provinces and states of Canada, Mexico, and the United States, led me to take a broader view of the situation, and a little later, after Dr. Abbott's resignation from the chairmanship of the Association's committee and my appointment, at his request, to the position, I recommended, at the meeting at Philadelphia in 1897, the use of the Bertillon classification by all of the countries represented in the Association and by their states, provinces, and cities. The recommendation met with some opposition, and was not finally passed

until 1898. It contained also a proposition that there should be a revision of the classification as reported at Chicago in 1893, so that it would be more acceptable in some respects for general use, beginning with the year 1900, the date upon which the Federal census was to be taken, and a decennial revision thereafter. This recommendation was cordially approved by the International Statistical Institute at Christiania in 1899, and the First International Commission was held at Paris in August, 1900.

The United States Bureau of the Census was not on a permanent basis at the time when these events occurred, and consequently took no part in the general adoption of the classification by the states and cities of this country. As soon, however, as the work of compilation began, the chief statistician of the census for vital statistics, Mr. William A. King, adopted the International Classification as revised at Paris in 1900, and used it for the mortality statistics of the calendar year 1900, thus making it, as I believe, the first great mortality report in the world to be compiled according to the revised classification, which did not go into effect generally until 1901.

The Census Office was not represented in the International Commission of 1900, nor any of the registration officials of the states and cities whose co-operation in the adoption of the International Classification had rendered possible, in the language of Dr. Bertillon himself, "the accomplishment of that great end, international uniformity, desired for fifty years by European statisticians, and which had not been possible until the action of the American Public Health Association at Ottawa in 1898." National committees or commissions, however, were formed to represent the three countries, one for Canada, one for Mexico, and one for the United States. The American Commission consisted of Dr. Samuel W. Abbott, of Massachusetts, Dr. A. G. Young of Maine, and myself, who acted as secretary, and published in the Michigan *Monthly Bulletin of Vital Statistics* from month to month many recomdations and suggestions from registration officials in regard to he work of revision. In spite of this, however, we had abso-

lutely no official recognition, and I did not even know of the date of the meeting of the commission or that it had been held until after its work had been completed. I can well remember, as a state registration official, the blank feeling of disappointment that came over us when we found that we were absolutely ignored in the official revision which had been brought about through the recommendations of our Association.

I am very glad to say that conditions were different this year, and that the Bureau of the Census, now permanently organized, has consistently urged as an essential point that the United States should be represented in the Second Decennial Commission of Revision by delegates chosen from the registration officials of the United States and from the medical profession, upon whom the Federal Government is entirely dependent for the primary data relating to causes of death; and that Congress has recognized for the first time in the history of the United States and after many years of acceptance, practically gratuitously, of the statistics obtained from registration sources, that the men who furnish the material for the vital statistics of the United States should be officially recognized in the important task of deciding how such data can be made most useful and acceptable for sanitary workers in this country.

That this was in fact carried out is due to the prompt action taken, immediately after his installation, by the Director of the Census, Hon. E. Dana Durand. My former chief, Hon. S. N. D. North, was earnestly interested in the adequate representation of the Bureau of the Census in this International Commission. Items were included for this purpose in legislation before Congress, but for various reasons in connection with the long-deferred action upon the general census bills no legislation was obtained. This representation was *vital* to the census. It could not hope to retain its prestige as a leader in the adoption of uniform methods of classification and as a guide to the registration states and cities unless it could be represented, as were the registration offices of other countries, in a commission whose action was to determine

the practical compilation of statistics for the United States for the next ten years. I felt this to be so urgently needful that only a day or two after my first introduction to Dr. Durand I presented the matter to him, and after brief consideration he directed me and the other members of the Census Commission, Dr. Wilmer R. Batt, State Registrar of Pennsylvania and chairman of the Committee on Vital Statistics of the American Public Health Association, and Dr. Frank P. Foster of New York, chairman of the Committee on Nomenclature of the American Medical Association, to proceed to Paris and attend the meeting. Of course, Dr. Durand's action would not have been possible without the support of those who felt that assurance could be safely promised for the necessary legislation. Thanks should be rendered especially to Hon. Charles Nagel, Secretary of the Department of Commerce and Labor of which the census constitutes a bureau, Hon. Elihu Root, senator from New York, who as Secretary of State had recommended the proper representation of the United States, and Hon. James A. Tawney, chairman of the House Appropriations Committee. The necessary authorization was included in Public Act No. 1, approved June 29, 1909, or only two days before the beginning of the session. Dr. Batt and myself, Dr. Foster unfortunately having been unable at the last moment to sail, saw the shores of France on the morning of June 29, and we sat in the morning session of the commission on July 1 at the Ministry of the Interior not far from the Élysée Palace in Paris.

When we reached Paris on the afternoon of June 29, after a very pleasant but uneventful voyage, during which we had the privilege of consulting with Professor William H. Welch, of Johns Hopkins University, Baltimore, president-elect of the American Medical Association, our first business was to ascertain our position with respect to credentials for the commission. We were utterly without information as to what had been done since we left Washington, and were not a little anxious in regard to our position, as the members of our commission had not received those official credentials

which are so necessary in the somewhat formal procedures abroad. We accordingly sought the aid and counsel of Hon. Henry White, ambassador of the United States, and, after his first natural feeling of consternation was over at the apparition of two Americans who dropped in casually and informed him that they desired to participate as official delegates of the United States in an International Commission called by the French Government to meet on the following day, he gave us the most cordial and effective assistance.

By cablegram between the ambassador and State Department at Washington and from myself to the Director of the Census, matters were at once adjusted, by the prompt action of the French Foreign Office, so that on the following day we sat in the International Commission as fully accredited official delegates of the United States. I also found in Paris Professor Willcox, of Cornell University, who had some time before been accredited to the commission by the Department of State; Surgeon F. L. Pleadwell, special delegate of the Navy Department; and Surgeon-General H. D. Geddings, representing the United States Public Health and Marine-Hospital Service. Dr. William H. Guilfoy, registrar of records of Greater New York, who was sent as a special delegate by the Health Department of that city, and who was duly included with Dr. Batt and myself as official delegates of the United States, reached Paris on the evening of June 30, and met with the American delegates on the same evening at Dr. Pleadwell's hotel, where we planned our action for the following day.

In regard to Dr. Guilfoy's appointment by the Health Department of the city of New York, which was made at a time when it seemed almost certain that the registration officials of the United States would have no representatives at Paris, I feel that the most cordial thanks are due to the city sanitary authorities for thus delegating him.

It may be of interest to you to know that Dr. Guilfoy, as registrar of records of Greater New York, annually compiles more deaths under the International Classification than are compiled for any other city in the world under any system.

The number of deaths in New York City for the year 1908, for example, was 72,995, while in London the deaths registered for the fifty-three weeks ended Jan. 2, 1909, numbered only 68,239, or 4,756 less. Of course, London has a somewhat larger population than New York (4,795,757 as compared with 4,338,322 for the middle of 1908), but the London death-rate is somewhat lower than that of New York, so that the total number of deaths, as stated, is greater than the number compiled in any other city in the world.

In the same way Dr. Batt, as State Registrar of Pennsylvania, annually compiles under the International Classification more deaths than any other state office in the United States, and probably more than any other office, not a national office, in the world. Although the total number of deaths for the State of New York somewhat exceeds the total number for Pennsylvania, the State Health Department at Albany does not make the compilation for four cities of that state,—Albany, Buffalo, Greater New York, and Yonkers,—so that the number of certificates actually received and compiled by the state office at Albany is much less than those received at Harrisburg for the State of Pennsylvania.

I shall not go into detail as to what was done in regard to the changes in the Classification at Paris. The preliminary report of the Census Commission and the revised list of titles will be found in Census Bulletin No. 104, which will be published in a very few days and copies of which will be sent to all of the registration officials of the United States and to the members of this Association. A new Manual of Classification will be prepared for the use of the registration offices of the United States as soon as the detailed results of the revision are available, and an effort will be made to bring the revised classification to the attention of every physician and local registrar in the country as an aid to the proper reporting of causes of death.

If the Census Commission had accomplished absolutely nothing in the way of practical reform, it would have been well worth sending, in order that the country should occupy

the place to which it is entitled in the councils of the nations which employ this classification; but, as a matter of fact, very much was accomplished.

Dr. Foster, as chairman of the American Medical Association's Committee, and Dr. Batt, as chairman of the Committee of the American Public Health Association, have been engaged for over a year in co-operation with the Bureau of the Census and with committees appointed by many national medical organizations devoted to special branches of medicine, upon the question of the proper classification and nomenclature of diseases with special reference to the improvements to be made in the International Classification at the recent revision. Meetings were held by these committees at Philadelphia, New York, and Washington, and important suggestions were formulated which were duly transmitted to the Secretary-General, Dr. Bertillon, and were laid before the commission in the special book prepared for its use. A very considerable proportion of these were adopted by the International Commission. Perhaps the most important of all the measures especially recommended by the United States was the improvement in the principle of the statistical classification of deaths from violence. Dr. Bertillon, Dr. Livi, of Italy, and myself were appointed a special committee of the Commission to adjust this portion of the Classification. I believe that the list as revised will be much more acceptable to American registrars, and that it will give the information in regard to the industrial causes of mortality in a more satisfactory way than any classification previously prepared. Of course, all of the recommendations of the American delegates could not be adopted. There were twenty-three countries represented in the International Commission, and conservatism is a characteristic of European officials, and especially of European statisticians. It is perfectly right that this should be so, because it creates endless confusion when many changes are made in an established system of compilation. Furthermore, it is hardly to be expected that a country like the United States, whose registration officials had never before joined in an international congress and whose

statistics relate to only about one-half of the population of the United States, should be able to prevail against the established views of the representatives of countries where complete and comprehensive vital statistics have been published for a long series of years. Nevertheless, the fullest consideration was given to the American propositions, and the utmost courtesy and harmony prevailed. I feel that the American delegates owe profound thanks to the Secretary-General, Dr. Bertillon, and to the French Government, and that American registrars should loyally abide by the recommendations adopted, and use the International Classification without any modifications or changes, except such as are entirely permissible under its constitution, for the next ten years.

We start out now at the beginning of a new census decade with the revised classification of causes of death, in which American registration officials and American physicians have had their say; a revised standard certificate of death, which will be adopted by the American Public Health Association at Richmond next month, I feel entirely confident, and put into effect for all of the registration area, beginning Jan. 1, 1910; and with new rules and instructions recently formulated by the Director of the Census, and promulgated to all reporting offices for the purpose of obtaining more complete and correct transcripts of the deaths now registered.

In regard to the last I may now say a word. The inspiration for this effort came from my observation of the methods employed in the national registration offices of France and England. The Bureau of General Statistics under M. Lucien March receives individual returns of deaths from all parts of France in a manner similar to that in which we receive transcripts of deaths from the registration area of the United States. Prior to 1903 such returns were not made to the central bureau, but the statistics of France were based upon compilations made in the departments. At the present time in France, as in the United States since 1900, the national mortality statistics are based upon compilations made at the central office, and it was therefore of special interest to see the manner in

which these returns were received from the local registrars and handled at Paris. We have yet very much to learn with respect to care and precision in this matter in the United States. Our difficulties arise partly from the fact that the returns made to the Bureau of the Census are entirely for statistical purposes, and are not official legal records such as pertain to a national registration office. Nevertheless, we can make great improvements, and I believe that the circular of instructions recently issued by the Director and the monthly accounting for all returns, with prompt correction of discrepancies between the numbers reported by the States and cities and the transcripts received by the Bureau of the Census, will tend to eliminate, I hope completely, the differences that have occurred between the Federal and local compilations and form a basis of standard tables for the calendar year corresponding to the census of 1910, and for subsequent years.

The same extreme care in the reception and correction of returns, and especially the correction of personal particulars relating to the individual, was apparent in the Registrar-General's office of England, through which I was shown, with the fullest possible explanation of all details of administration and classification, by Dr. John Tatham, who has very lately retired as the Medical Superintendent. Here, again, may I note the immense value of personal contact with the leading registration officials of other countries. Dr. Tatham supplied to me, for the use of the Bureau of the Census, a copy of his personal instructions in regard to the compilation of joint causes of death,—something which has never heretofore been permitted to go out of the Registrar-General's office. As in the reforms in this country, which, I think, have been possible only through the meeting together of registration officials in the American Public Health Association, so, I believe, future reforms in international statistics, and the accession of Germany, England, and other countries which are not yet users of the International Classification, may be brought about through the personal acquaintance and confidence that result from international meetings. I am especially hopeful that it will be

possible for the Third Revision of the International Classification to be called by the American Government to meet in Washington in 1919. As the beginning to this desirable end, I hope that the American Statistical Association will unite with the American Public Health Association in a joint meeting at Washington next year at the time of the International Congress on Hygiene and Demography, when the most eminent sanitarians and vital statisticians of the world will be here.

A STUDY OF NEW ENGLAND MORTALITY.

By Harry A. Richards.

The study of mortality tables has always disclosed interesting facts as to the life of a community. William Farr, the eminent English statistician, has set forth in many places in his reports the advantages of their use, and has constructed many valuable tables. Such tables and deductions from them have been made, indeed, in the other leading European countries. But in the United States adequate statistics on which to base them have been, until very recent years at least, wholly lacking. Some records of deaths and births, and of population, are to be found, however, in New England, extending back to the earliest times. I have attempted to make some use of these data, and to criticise my own results in such a way as to be sure of not proving too much. It is not without utility to prove that nothing can be proved, if no better result can be reached.

The prevalent notion is that conditions favoring longevity are increasing, and this is probably correct in respect of recent times. That it was so uniformly, from the settlement of New England, is certainly open to doubt. Professor Bailey, in his "Modern Social Conditions," says, after giving Wigglesworth's life-table for Massachusetts constructed in 1793 or thereabouts (see Table IV) and the Board of Health Table for Massachusetts constructed in 1897 (see Table II), "We see from this table that in the course of a century the expectation of life at birth has increased sixteen years for males and eighteen for females, assuming that the figures for males and females are identical at the earlier date." This sort of comparison is of doubtful value, for it does not take into account the fact that the two tables were constructed on entirely different principles. Wigglesworth himself knew the limitations of his work very well, and in fact made a correction for the

earlier ages of his table, which makes Professor Bailey's comparison inaccurate, even on the face of the tables, not regarding the difference in method. In my own investigation I have tried to keep such differences in mind and to discount them.

First, let us inquire as to the change in the force of mortality during the last half-century (see Table II). The table of 1897 and Elliott's table of 1855 were both constructed on the correct principle, comparing the actual deaths with the actual living population. A comparison of them is therefore permissible. This comparison discloses the fact that mortality has lessened most markedly in the years of infancy and childhood, and to a less degree in later life. The results are well stated in the Report of the State Board of Health for 1897. Table III presents the same facts, in the form of death-rates. These two tables are the only ones that can be considered finished products, based on adequate data. They seem to show an increasing expectation of life and a saving of many years of existence to the population.

The next preceding effort to make a historical study of mortality that I have found was Lemuel Shattuck's Essay on the Vital Statistics of Boston from 1810 to 1849 (see Table V). He says: "It has been repeatedly said that the great improvements in the science of medicine—in the nature and treatment of disease, and other causes, have increased the average longevity of mankind; that life is more valuable now than it formerly was; and that these improvements are constantly going on. The value of life is estimated by the number of years we live. A long life is more valuable than a short one. It is said to be improved in value when the various circumstances, which surround us, add to the number of years of existence, as compared with other causes, which have existed in other places or periods of time. No correct conclusion can be made in regard to such comparison, except by careful examination of the facts.

"This comparison . . . shows that, although the average value of life is greater now than during the last century, it is not so great as it was twenty years ago."

This is a clear and valuable statement of what investigations

of this kind can prove, and it is also valuable as an interpretation of the results he was able to get from the bills of mortality of Boston. These show a positive decrease in the expectation of life during the period of his observations. He accounted for this by overcrowding, by the prevalence of "luxury and effeminacy," and by the heavy infant mortality. At any rate, here was a time when a steady betterment of conditions conducing to longevity was not the rule.

The next table before this was Wigglesworth's, published in 1793, constructed from deaths alone, and used for many years in Massachusetts courts as an authority on American mortality. Data were also collected by President McKean, of Bowdoin College, which I have cast into a form of a mortality table (see Table VI).

The extant tables, then, carry us back about one hundred and twenty years or thereabouts. What was the change which took place during the century and a half before that, from the founding of the colonies in Massachusetts down to the time Wigglesworth wrote?

To answer this question, it would have been desirable to have complete lists of deaths each year, classified by age, and frequent and accurate censuses, also classified by ages, neither of which exist. The town records of Massachusetts, however, contain in many instances the age at death; and genealogies (usually based on the records or on deeds or letters) also contain the same information. From these two sources I have constructed three mortality tables (see Table I). The first table (column 1) is based on lives begun and ended in the seventeenth century; the second, on lives born in the seventeenth century; and the third, on lives born in the eighteenth. The method of treating these data was the one ordinarily used where no record of population is available. The quite unusually high expectation of life in infancy and for the years of life before fifteen, is fairly conclusive evidence that the larger part of the infant mortality was not recorded. This might have been expected. Above the age of fifteen, however, there is no reason to suppose an uneven omission of deaths at any particular age,

and the question then becomes this: Are the differences shown by a comparison of these tables with later ones due to a change in the force of mortality, or are they due to a change in age-constitution? Tables constructed according to Halley's method are subject to correction, according to the following scheme: If the population is stationary, the correction is zero; if the population is increasing, the expectation is too small, and must be increased; if decreasing, the expectation must be decreased. This is easily perceived to be true, for, if the population is increasing, there will be a disproportionate number of deaths at the young ages (the age-pyramid will bulge at the bottom), and this will shorten the expectation. Now New England's population was certainly increasing in the seventeenth and eighteenth centuries. Wigglesworth made a correction for this in his own table. The correction is indefinite for lack of statistics of population, but it would need to be made for both of the earlier centuries, and would tend even to increase the expectations given in columns 2 and 3. If this correction affected the table for the eighteenth and the seventeenth centuries in the same way, a comparison of them as they stand is permissible. This is reasonable on its face, and there is not much evidence to the contrary. It will be noted from Table VIII, where the order of the various expectations is given for all the tables discussed in this paper, that the expectation for the seventeenth century was greater than that for the eighteenth for every age from fifteen to forty: the order is reversed for ages forty to seventy, but the earlier century has again the advantage for the rest of life. What evidence can be gleaned from these tables, therefore, would seem to indicate a decrease rather than an increase in longevity from the seventeenth to the eighteenth century. What reason can be assigned for this? A statement in the Report of the Massachusetts Board of Health for 1897 is quite in point, although intended to apply to a later period: "The population of almost any one of the United States differs essentially from the more stationary populations of the old world in the fact that it is constantly being recruited by the addition of considerable numbers of immigrants at the healthy ages of life.

These additions constitute a selected class, not only on account of their age distribution, but also because many of the weaklings must be left behind, in consequence not only of their inability to become wage-earners, but on account . . . of the immigration laws." This was true at the early date for which these tables speak except the last clause. Possibly, therefore, after a hundred years or so the race was not quite so uniformly robust and hardy as it was during the early days. This is merely a tentative explanation.

For every age from fifteen to forty Wigglesworth's table—which was constructed on the same sort of data as mine—shows a lower expectation: from then on it is higher than my tables. This, again, does not indicate a marked increase in expectation: on its face, it indicates a decrease, but I am loath to insist on that interpretation. The changes in mortality during the later periods I have set forth above.

The net result, therefore, which seems derivable from this investigation is that during the last half-century longevity in Massachusetts, and probably in New England, has increased, that from 1793 to 1850 the increase is less certain, and from the seventeenth century to the eighteenth century what data we have point rather to a decrease than to anything else.

I will now give a brief statement of the materials and methods used in constructing my own tables, and try to meet certain objections thereto.

The town records of Massachusetts, as reprinted by the New England Historic-Genealogical Society, together with various family histories, furnished the material.

These town records of Massachusetts are very useful: the idea was originated by the society; and their value as a matter of historical record has been impressed upon the other New England States. Maine passed a law providing for similar work, but it was inoperative. New Hampshire is collecting the records of Concord. The records of some few Connecticut towns are in print. But beyond these there seems to be little prospect of such a work being done systematically for the whole of New England.

The society has in its possession the records of a considerable number of tombstones in Massachusetts, which have been copied by local antiquaries and genealogists into blank books provided for the purpose. These also furnished me some material, especially for the earlier century, and especially those of Copp's Hill and King's Chapel, Boston.

The method followed in manipulating these figures was the tabulation of the ages at death, and the computation from that of the average after-lifetime, or expectation.

Many of the difficulties usually encountered in life-table construction have been avoided, notably the adjustment of the infant mortality; for the records of infant mortality are so incomplete for this early period that almost no significance can be attached to them. Nor was it necessary to go through any adjustment of the population to the age-groups, for the population from which the deaths occurred is necessarily disregarded.

One objection to this method, and possibly a valid one, is that it is possible for a life to be repeated; that is, to be gathered from two different sources, and thus appear twice in the data, and receive twice its due weight in the computations. As to this point, however, it is worth noting that the Seventeen Offices Table, an English table, was based on policies which became claims rather than on lives that ended. Since one person might carry more than one policy, a life in this table could be repeated in the same way. The Encyclopædia Britannica, art. Insurance, says of this table: "The general agreement of the results with those derived from other data referring to persons and not to policies, seems to show, however, that the peculiarity referred to does not materially affect the accuracy of the table as an exponent of the value of assured life." This was probably true also in the case of these tables.

TABLE I.

EXPECTATION OF LIFE.*

Three life tables: (1) from lives begun and ended in the seventeenth century, (2) lives begun in the seventeenth century, (3) lives begun in the eighteenth century.

Age.	(1)	(2)	(3)
0	59.44	58.24	48.81
5	57.17	54.65	47.59
10	52.58	50.02	43.94
15	47.91	45.44	40.27
20	43.43	41.19	37.25
25	39.76	37.45	35.01
30	35.94	33.88	32.21
35	32.23	30.45	29.79
40	28.76	27.07	26.95
45	25.20	23.56	23.79
50	21.84	20.32	20.73
55	18.83	17.25	17.88
60	15.77	14.32	14.84
65	13.14	11.87	12.03
70	10.74	9.45	9.63
75	8.38	7.59	7.46
80	6.44	5.84	5.72
85	5.59	4.72	4.66
90	4.02	3.75	3.10
95	3.34	2.50	2.53
100	.86	.50	.90

*Column (1) is based on the records of 1,632 deaths, taken from Potter's "Concord Lives," and several genealogies; column (2) is based on the records of about 3,500 deaths from the Granary, King's Chapel, and Copp's Hill burying-grounds, Boston, from the New Haven Cemetery, and from several genealogies; column (3) is based on about 4,000 deaths, from the town records of Medfield, Dedham, Medford, Rehoboth, Newton, Northboro, Milton, Millbury, and Medway, and from several genealogies.

TABLE II.

Expectation of Life.

Summary of two life tables: (1) E. B. Elliott, Massachusetts, 1855; * (2) Massachusetts, 1893–97.†

Age.	(1)	(2)	
	Males and Females.	Males.	Females.
0	39.77	44.09	46.61
5	50.17	52.88	54.17
10	47.07	49.33	50.70
15	43.04	45.07	46.53
20	39.86	41.20	42.79
25	36.92	37.68	39.29
30	34.03	34.28	35.85
35	31.01	30.87	32.43
40	27.86	27.41	29.00
45	24.62	23.93	25.54
50	21.32	20.53	22.10
55	18.13	17.33	18.81
60	14.97	14.38	15.74
65	12.12	11.70	12.90
70	9.41	9.34	10.36
75	6.80	7.37	8.29
80	4.95	5.70	6.56
85	3.66	4.31	5.07
90	2.86	3.16	3.73
95	2.26	2.22	2.60
100	1.58	1.21	1.58

* Proceedings of the American Association, vol. xi, p. 51.

† Massachusetts State Board of Health Report, vol. 30, p. 822 (1898).

TABLE III.

DEATH-RATES BY AGES AT VARIOUS DATES IN MASSACHUSETTS.*

Age.	Years.				
	1865.	1875.	1885.	1895.	1900.
0–1	205.28	226.56	212.49	215.89	190.10
0–5	68.62	73.96	67.00	64.51	57.79
5–10	9.63	9.77	7.46	6.23	5.26
10–15	5.14	4.72	3.77	3.18	2.93
15–20	9.63	7.73	6.35	5.34	4.82
20–30	12.58	10.49	9.08	7.08	6.95
30–40	11.68	11.30	10.62	9.67	8.75
40–50	11.68	12.97	12.96	12.65	12.04
50–60	17.49	18.29	19.71	20.45	21.28
60–70	32.90	34.79	36.19	39.37	41.03
70–80	70.48	71.11	76.16	82.41	85.83
80–	168.23	176.41	182.32	184.65	197.82

* Massachusetts Registration Report, vol. lxv, p. 206.

TABLE IV.

SUMMARY OF REV. EDWARD WIGGLESWORTH'S MORTALITY TABLE FROM SIXTY-TWO BILLS OF MORTALITY* (WITHOUT HIS CORRECTIONS FOR INCREASING POPULATION).†

Age.	Expect.	Age.	Expect.	Age.	Expect.
0	28.15	35	28.22	70	10.06
5	40.87	40	26.04	75	7.83
10	39.23	45	23.92	80	5.85
15	36.16	50	21.16	85	4.57
20	34.21	55	18.35	90	3.73
25	32.32	60	15.43	95	1.62
30	30.24	65	12.43	100	—

* Memoirs American Academy, Boston, 1793, vol. ii, p. 131.

† Wigglesworth's correction for the ages up to 15, inclusive, is omitted, so that the table may be strictly comparable with Table I, above, where no correction was possible.

TABLE V.

SUMMARY OF SURVIVAL COLUMNS FOR THREE DIFFERENT PERIODS FOR THE CITY OF BOSTON, PREPARED BY LEMUEL SHATTUCK.*

Age.	Number Surviving.		
	(1811–20.)	(1821–30.)	(1831–39.)
0–5	100.00	100.00	100.00
5–10	66.36	62.96	56.91
10–20	62.82	59.17	52.64
20–30	57.46	54.20	47.56
30–40	43.33	41.12	34.83
40–50	31.11	28.15	23.43
50–60	20.25	18.00	15.45
60–70	13.26	11.29	9.78
70–80	7.58	6.45	5.32
80–90	2.77	2.45	1.90
90–100	.36	.34	.35

* Vital Statistics of Boston, published by Lea & Blanchard, Philadelphia, 1841.

TABLE VI.

SYNOPSIS OF SEVERAL BILLS OF MORTALITY, BY REV. JOSEPH MCKEAN, PRESIDENT OF BOWDOIN COLLEGE.*

(McKean did not put his work into the form of a life table. He gave only the column headed "1x" below. The work of computing the expectation is given below.)

Age.	dx.	1q.	2Px.	2Qx.	Ex.
0–5	2,500	6,576	106,520	491,370	37.36
5–10	337	4,076	78,150	384,850	47.21
10–20	397	3,739	70,810	306,700	41.01
20–30	629	3,342	60,550	235,890	35.29
30–40	457	2,713	49,690	174,340	32.13
40–50	401	2,256	41,110	124,650	27.64
50–60	324	1,855	33,860	83,540	22.52
60–70	433	1,531	26,290	49,680	16.22
70–80	574	1,098	16,220	23,390	10.65
80–90	429	524	6,190	7,170	6.84
90–100	92	95	950	980	5.15
100—	3	3	?	?	?

* Memoirs American Academy, vol. ii, Part II, p. 66.

These data were collected from Roxbury, Marblehead, Stow, Brimfield, Westfield, East Kingston, Barnstable, Hamilton, Exeter, Salem, Edgartown, Beverly (first parish), Ipswich, Salisbury, Montague, Northboro, Hanover, Gloucester, Brookfield (third parish), Cambridge, Fryburg, Wenham, Wilmington, Northampton, Newbury, Reading, Weymouth, West Hampton, Hampton, Dover, Waltham, Newton, Falmouth, West Springfield, Hatfield, Ashburnham, Marblehead (second parish), for different periods, ranging from 1772 to 1790, approximately, with a few earlier records.

TABLE VII.

Summary and Comparison of Previous Tables.

(This table shows, first, the *order* of the values of the expectation of life for the various tables, beginning with the highest, and so on down, Nos. 1, 2, and 3 referring to Table I, columns (1), (2), and (3), No. 4 to the Wigglesworth table, No. 5 to Elliott's 1855 table, and No. 6 to the Board of Health's 1897 table; and, secondly, the *range* of the values of the expectation at each age,—*i.e.*, the difference between the highest and the lowest. This table starts at age 15, as the values below that are too widely divergent to be significant, since the divergence is undoubtedly due to defects of record.)

Age.	Order.	Range (years).
15	1—6—2—5—3—4	11.41
20	1—6—2—5—3—4	9.22
25	1—6—2—5—3—4	7.44
30	1—6—5—2—3—4	5.70
35	1—6—5—2—3—4	4.01
40	1—6—5—2—3—4	2.72
45	1—6—5—4—3—2	1.64
50	1—6—5—4—3—2	1.52
55	1—4—5—6—3—2	1.58
60	1—4—6—5—3—2	1.45
65	1—4—6—5—3—2	1.27
70	1—4—6—3—2—5	1.33
75	1—(4—6)—2—3—5	.92
80	1—6—4—2—3—5	1.49
85	1—2—6—3—4—5	.90
90	1—2—4—6—3—5	1.16
95	2—1—3—6—5—4	1.88
100	5—6—3—1—2—	1.08

NOTES.

THE TWELFTH SESSION OF THE INTERNATIONAL STATISTICAL INSTITUTE AT PARIS, 1909.

The Twelfth Session of the International Statistical Institute occurred in Paris, July 4–10, 1909. In fact, it was opened informally on the evening of the 3d, when M. Levasseur gave a private reception to the members at the Collège de France.

The Institute was saddened by the death of its president, the distinguished Austrian, Dr. Karl Theodor von Inama-Sternegg, who since the death of its first president, Sir Rawson Rawson, in 1899, had presided over its deliberations. The duties of the presidency fell upon the vice-presidents, MM. Levasseur, Lexis, and Troinitsky, and especially upon M. Levasseur, as senior vice-president, chairman of the Committee of Organization and administrator of the Collège de France.

There were present 82 members of the Institute and 70 invited guests, or a total of 152, 54 of whom were official delegates from their respective governments, 31 members of the Institute, and 23 invited guests. Those who attended from the United States were Dr. W. R. Batt, Dr. W. H. Guilfoy, Dr. F. L. Pleadwell, Dr. Cressy L. Wilbur, Mr. W. F. Willcox, and Mr. F. L. Hoffman, the first five being delegates on the part of the Government to the International Commission for the Decennial Revision of the Classification of Diseases and Causes of Death which convened in Paris just before the session of the Institute, and the last two attending the session of the Institute as delegates from the United States.

The session opened formally on the morning of July 4, in the splendid Amphitheatre of the Sorbonne, under the presidency of the Minister of Labor, M. René Viviani, who welcomed the Institute in the name of the French Government. He paid fitting tribute to the deceased president, and dwelt upon the important relations between statistics and legislation.

M. Levasseur, as senior vice-president, responded on behalf of the Institute. His address dealt particularly with the responsibility of statisticians. He also referred to the deaths which had occurred in the ranks of the members since the preceding session; namely, those of Dr. von Inama-Sternegg, Professor Kauss, Mr. Hendriks, Mr. Wilson Fox, and Mr. Carroll D. Wright. Following this address, Dr. Lexis

read a paper on "Economic Crises." The meeting concluded with the organization of four sections: I. Methods and Mathematical Statistics; II. Demography; III. Economic Statistics; IV. Social Statistics. The section on Methods and Mathematical Statistics was an innovation, inaugurated mainly through the efforts of M. Lucien March.

Section I. was presided over by Professor Edgeworth as president and Signor Perozzo as vice-president. A paper by M. Waxweiler discussed the various fields in which statistics are now used, comprising meteorology, anthropology, psychology and biology, as well as economics. On his motion the section recommended that courses in the theory of statistics should be introduced into the programmes of work in biology and psychology, as well as in the social sciences. As a result, a committee on the teaching of statistics was appointed later in the session, with Mr. Bowley as chairman. As the outcome of a paper by M. March, "On the Application of Mathematical Processes to the Comparison of Statistics," a committee was appointed on technical methods of statistical comparison. Papers were also read in this section by Professor Edgeworth, on "The Applications of the Calculus of Probabilities to Statistics"; by Mr. Yule, on "The Applications of the Theory of Correlation to Social Statistics"; by Signor Perozzo, on "The Determination of the Age Distribution of Married Couples, given the Distribution of Ages at Marriage and the Law of Mortality"; and by M. Borel, on "Differential Methods."

In Section II.—Demography—Professor von Mayr was chosen president and Dr. Bertillon, vice-president. In reporting for the committee on the statistics of tuberculosis, Professor Lexis suggested that, in cases of death from that disease, inquiry should be made whether any other member of the family had died of the disease and that deaths should be classified according to the housing conditions of the family. The relation between tuberculosis and alcoholism in the various departments of France was discussed by M. Bertillon. He showed that the departments of northern and north-western France, where beer and cider are the common drinks and where the per capita consumption of alcohol is greatest, are just the departments in which tuberculosis is most prevalent. M. Nicolai presented the report of the committee on the fecundity of marriages and the number of children to a family. After recounting the resolutions adopted by the Institute at Copenhagen in 1907, he stated that the committee had prepared three models of questions and drafts of twelve tables. He said that the committee did not expect to impose the tables which it had outlined; it desired merely that the Institute should recommend them to statisticians. The inquiries recommended allow the establishment of distinctions in the censuses. The committee, he said, would be happy to see an attempt made at the distribution of families into social groups. Other papers

presented were: "Infant Mortality in France and in the Netherlands," by M. Huber and M. Methorst, respectively; "Urban Populations," by M. Meuriot; "The Census of Tokio and Kobe," by Mr. Yanagasawa; "Marriage and Divorce Statistics of the United States," by Mr. Willcox; "Statistics of the Blind," by Professor von Juraschek; and "The Distribution of the Sexes of Consecutive Children of the Same Mother," by M. March.

In Section III.—Economic Statistics—M. Yvès Guyot was chosen president and M. Raffalovich vice-president. M. Levasseur made a report on the course of corn prices in the various countries, and, after considerable discussion, the question was again referred to the Committee on Corn Prices. It was decided to get information as to the method of collecting data of prices in the United States and Canada, and some suggestions looking toward international uniformity were made. M. Raffalovich presented the report for the committee which had been appointed at Copenhagen to investigate bounties and subventions given by the different governments to navigation, commerce, agriculture, and industry. It was decided to continue the investigation. Mr. Kiaer made a report on the social distribution of incomes, and it was voted to continue this investigation further by means of a committee. A committee was also appointed to consider the establishment of a statistical record of state and municipal industrial undertakings. A communication was read by M. Bertillon on international statistics of inheritances. After a study of the statistics of France, Italy, England, Spain, Holland, and Rumania, he concluded that the proportion of persons leaving property at death is greatest in France. He raised the question as to whether the state of prosperity revealed in France by this study may not be one of the determining causes of the low birth-rate. In all of the principal countries, except Holland, small inheritances form the majority. He declared the statistics to be interesting for more than one reason, but that they could not be considered an index of the distribution of wealth. A paper was read by M. de Wendrich on "The Statistics of International Transportation." Though recognizing the difficulty of the undertaking, Mr. Zahn thought the Institute should make an attempt to secure statistics showing the financial systems, receipts, expenditures, liabilities, and wealth of all nations. After some discussion a committee was appointed to study the ways and means of establishing comparable international financial statistics, commencing with public expenditure.

The President and Vice-President of Section IV.—Social Statistics—were respectively MM. Delatour and Mataja. The Committee on Statistics of Industrial Accidents presented its report through M. Fuster. Considerable discussion followed, opinions differing about the possibility and desirability of securing greater details. Three forms of return sug-

gested by the committeee were adopted "in principle." These and other proposals submitted to the General Assembly were indorsed by it, and the committee was requested to confer with the permanent Committee on Social Assurance and to report at the next session.

A report was given by M. de Lannoy on recent progress in criminal statistics in Belgium. M. Tissier reported reforms in criminal statistics of France, and M. Methorst spoke for the Netherlands.

Proofs of the first edition of a technological dictionary of industries and occupations, prepared by a committee appointed at the Copenhagen session, were presented. The work was undertaken by the French Government with the assistance of members from other countries, the work being published in French, English, and German. It was carried through chiefly by M. March, Dr. van der Borght and M. Huber.

A committee was appointed in 1907 to prepare a dictionary of statistical terms in official publications. The committee reported that the first step was to prepare a list of all the terms used in the social sciences with the synonyms of each in the several languages, and after discussion the committeee was requested to prepare such a list of the terms constituting the statistical vocabulary.

Dr. van der Borght made an important suggestion for the establishment of an International Statistical Office under the direction of the Institute, by which a periodical bulletin should be published, giving in summary the important statistics of the various countries. He asked that a committee be appointed to investigate and report on this proposition. After considerable discussion a committee was elected by ballot as follows: MM. Bodio, van der Borght, Fontaine, de Foville, Guillaume, Hanabusa, Julin, von Juraschek, Kiaer, Lange, Mandello, March, von Mayr, Raffalovich, Rew, Sir Llewellyn Smith, Sundbarg, de Vargha, Verrijn Stuart, Willcox, and Zolotareff. The committee organized by choosing M. de Foville as chairman, M. von Juraschek as vice-chairman, and as reporters MM. van der Borght and Mandello.

The only American before the Institute as a candidate for membership, Dr. Cressy L. Wilbur, Chief Statistician for Vital Statistics in the Bureau of the Census, was elected.

The social events which add so much to the delight and also to the value of these biennial sessions, bringing together in frank and friendly intercourse many who before had been merely names to each other, were provided with the lavish and brilliant hospitality of which Paris and France are the synonym. A bald catalogue of them is all that can be added here. After the opening session on Sunday, July 4, the members and guests of the Institute with their ladies were received at the Palace of the Élysée by the President of the Republic and Madame

Fallières. On Monday evening the Committee of Organization gave a dinner. On Tuesday, after the general session of the morning, there was an excursion by rail to the beautiful château and Museum of Chantilly, luncheon being served on the way thither and tea on the return trip. On Wednesday the President of the Republic entertained some threescore guests at luncheon, and in the evening the Statistical Society of Paris held a session, followed by a banquet at which it was the host. On Thursday the scientific sessions were interrupted to give opportunity for a trip by special train to Rouen. After luncheon there the party divided into squads to see some of the delightful attractions in and near the ancient capital of Normandy, returning in the evening to Paris for a late reception at the palace of Prince Roland Bonaparte. On Friday after the sessions there was a brilliant reception at the Bank of France, followed by a gala-night at the opera, where "Samson et Dalila" was presented in honor of the guests. On Saturday the Society of Political Economy of Paris celebrated its twenty-fifth anniversary by a luncheon at the Pré Catelan; the Municipality of Paris in its turn received the guests at the Hôtel de Ville; and in the evening the farewell dinner was given by the Committee of Organization.

The three recent meetings of the Institute, at Berlin, London, and Paris, have all been marked by a brilliant profusion of social festivities, of which the foregoing enumeration conveys only a faint idea. They have been so devised and executed as by the very perfection of their arrangements to obscure the enormous labor involved in their preparation. In this respect the session at Paris, although unsurpassed by its predecessors, was yet obliged to follow in the lines they had laid down. In one particular it was unique, the personality of M. Levasseur. Whether he was presenting a scientific report at a section meeting, presiding over the general assembly, responding in the name of the Institute to the speech of welcome with a voice that perfectly filled the great amphitheatre of the Sorbonne, replying to a toast at a banquet, greeting old friends and making new ones at the social festivities, or welcoming all to his home at the informal reception which preceded the formal gathering, he exemplified the matchless charm of the French language in the hands of a master, the perfect hospitality and tact in which his nation are unrivalled, and the marvellous vigor which carried his more than fourscore years as if they weighed not a feather. The unique impression carried away from the session at Paris was the stimulus and the benediction all received from the senior vice-president.

WALTER F. WILLCOX.

A SHORTENING OF THE METHOD OF MAKING INTERCENSAL ESTIMATES OF POPULATION.

In the course of a university lecture on an economic subject the following method was recently recommended for computing the population of a city in 1909, when the population figures for 1900 and 1905 are known: Take the ratio of increase between 1900 and 1905, and multiply the population in 1905 by four-fifths of that rate. This obviously amounts not to "assuming a constant rate of increase," but to assuming a constant geometrical progression between the censuses, and for intercensal points an arithmetical ratio. In other words, in terms of the graphic method, intermediate points are taken on the chords of the curve rather than on the curve itself. The *consistent* method of computing intercensal estimates on the basis of a constant rate is so simple, and its employment in correcting estimates, after the results of the approaching census are published, is likely to be so common, that the following method, used by the writer in computing a large number of intercensal populations, is given in the hope that it may prove useful:—

The common problem is this: Given the population of a community in 1900 and 1905, on a certain month and day, to find the population for the middle of the year (on which most rates are computed) for some year between the two, or for some year between 1905 and 1910. Suppose, for example, the population on July 1 (middle of year), 1907, is required. Proceed as follows: take the logarithms of the population in 1900 (log P) and in 1905 (log P′), subtract them, multiply the difference by 25/60 (because, assuming the 1900 and 1905 censuses, as usual, speak for June 1, there are 60 months from 1900 to 1905 and 25 months from June 1, 1905, to July 1, 1907), and add this product to the logarithm of the 1905 population, then take the antilogarithm of that result, which is the required population. The work of multiplying a number by 25/60 may be set down as follows: to multiply, say, 16764 by 25/60,—

$$
\begin{array}{r}
6)16764 \\
\hline
4 \\
2794 \\
67056 \\
\hline
6985.0
\end{array}
$$

This abbreviated method amounts, it will readily be seen, to putting the fraction 25/60 in the form $\frac{41/6}{10}$ and performing the indicated oper-

ation. When a multiplying machine is not available and a slide-rule will not give results accurate enough (as it frequently will not, especially when the estimates must check and agree as to totals), this short method saves considerable time. As most intercensal periods are five years, or 60 months, the denominator would usually be 60. It can be employed to advantage where it is desired to multiply by any fraction of the form $\frac{ab+1}{10b}$, where a and b are integers less than 10. A fraction can therefore be readily tested as to whether multiplying by it can be so shortened by subtracting one from the numerator, and noting whether the result is divisible exactly by the denominator divided by 10. This process is also useful where arithmetical estimates, rather than geometrical, are made, the only difference being that numbers are used instead of their logarithms.

In view of the confusion existing among many investigators of problems requiring statistical treatment, as to a correct and easy method for making population estimates, it seemed desirable to give the above.

HARRY A. RICHARDS.